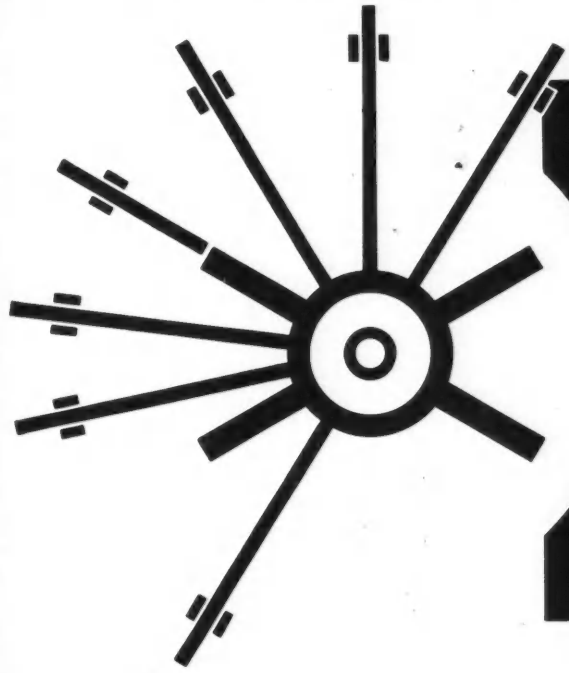
CENTRAL SUPPLY



YEARBOOK

FROM HOSPITAL TOPICS
VOLUME TWO

CENTRAL SUPPLY YEARBOOK

from

HOSPITAL TOPICS

Volume Two

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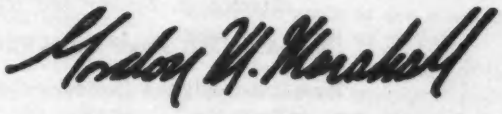
Foreword

SINCE 1952, when HOSPITAL TOPICS became the first hospital publication to recognize the importance of the central supply department, a special section in the magazine has provided central supply personnel with practical articles on up-to-date methods and procedures, and with ideas for improving efficiency within the department.

In 1956, the first in a series of yearbooks was published. This second volume brings together in permanent reference form the important material which has appeared in the central supply section of HOSPITAL TOPICS since volume one was published.



Gordon M. Marshall
Publisher

Contents

Newly Organized Central Service Improves Efficiency, Saves Money

By Brother Dominic, C.F.A.*

• In the hospital of today, central service has emerged as an independent factor in the maintenance and improvement of patient care. As administrators have realized the assistance central service can give to the nursing units, the emphasis on its utility has increased.

Alexian Brothers Hospital had previously had a central supply department which performed limited functions. In it were kept needles, syringes, oxygen tents, Wangensteen suction equipment, and thermometers. Only needles and syringes were sterilized in the department.

The administrative committees and the division of nursing services, after serious consideration, decided that a central service unit was needed.

The new department has now been in operation for over two years. The initial outlay of capital necessary for the establishment of the department soon was offset by the saving in material, by the reduction of losses resulting from carelessness of employees in handling equipment, and by the removal from the surgical team of the burden of assembling and sterilizing linen and instrument packs, and conditioning and sterilizing gloves.

With the establishment of a central service department, a cost analysis is of prime concern to administrators. Generally, the cost can be divided into two main categories, direct and indirect. Direct cost is concerned with such items as the number of personnel requisite for maintaining the department, personnel wages, and the cost of supplies. Indirect cost includes such items as necessary equipment, linen expenses, housekeeping expenses, and the expenses needed for the general household property.

Because it is the duty of the administration to regulate and guide the various expenditures of central service, the data should be broken down specifically into expendable and nonexpendable items. Expendable items then are broken down according to the manner in which they are used—for instance, those used in direct patient care and those used in preparing the necessities for such care, e.g., linen, gloves, powder, tape, steam, and electricity.

*Assistant administrator, Alexian Brothers Hospital, Chicago.

After we decided to establish a central service department, the administration committee evaluated proposed floor plans, nursing procedures, and utilization of material within the department. When a change in procedures involved major medical problems, or when standardization was necessary, the suggested changes were referred to the surgical committee of the medical staff for consideration and evaluation.

The nursing procedures were reviewed and passed by the administrative committee, and approved by nursing service. Since administration and nursing service work in such close harmony, few problems were encountered along these lines.

In some instances, minor changes, made previously, eliminated many of the unnecessary equipment and supplies that served no purpose.

Before the establishment of the department, there was a noted loss of equipment each month. To begin with, each movable item of equipment was numbered by the department and a record kept of the equipment and which division claimed it. Carelessness, breakage, and theft have decreased, with the result that many dollars have been saved for the institution each week.

The physical setup of the previous supply department was inadequate. As the accompanying drawing shows, at the present time soiled materials are received in one area and the dispensing of sterile and clean equipment is in another area.

In the revision and standardization of the department, central service was asked to pack and sterilize daily necessary linens for surgery, instrument packs, and drums from the various dressing rooms and emergency room area.

A perpetual inventory was set up. All equipment stored in various areas of the hospital was moved to the central area. All forms used within the hospital have been centralized within the central service department. This we feel is rather unique. It often happens that the purchasing agent is confronted by departmental heads with requisitions for various forms when the supply is extremely low. With centralization of all these forms, the central

service supervisor can easily determine when a supply is running low, and an order can be placed at the proper time.

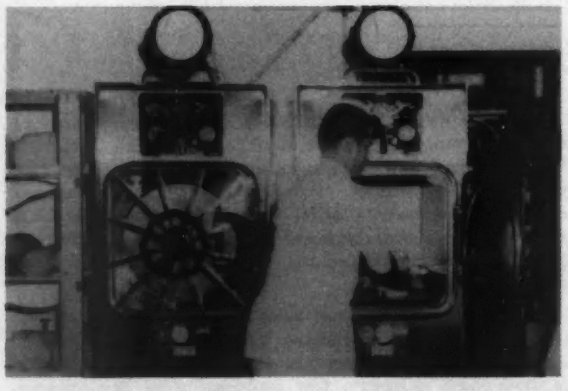
Oxygen equipment is stored in the department, as it was before. A minimal amount of oxygen is stored there —not exceeding the city code. Keeping oxygen in central service saves time for the personnel in the department, inasmuch as unnecessary trips are not made to the central storage area for oxygen.

DEPARTMENT STAFF

Additional personnel in the new area were necessary. The following schedule was drawn up to assure adequate coverage over the 16-hour period the department is open:

From 7 a.m. to 12 noon and from 3 p.m. to 6 p.m. are hours for the supervisor.

An attendant is on duty from 7 a.m. to 3:30 p.m.; from 9 a.m. to 5:50 p.m., and from 2:30 to 11 p.m.



After 11 p.m., the night supervisor utilizes the central service department as his office. If equipment is needed, he dispenses it to the various nursing units.

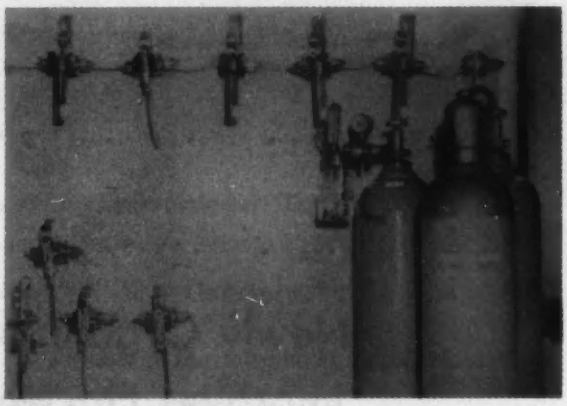
A pickup and delivery service has been instituted from 8 a.m. to 3 p.m. Any equipment needed outside of this period must be requisitioned by the floors. A Kardex gives the exact location of equipment within the central service department.

The re-evaluation of the department will never end. Continuous study is necessary in the standardization of supplies, procedures, and labeling of items.

In the establishment of the central service department, consideration should be given to present-day methods of doing a job, and more complete centralization. Items of primary concern will lead to space allocation, more complete centralization of functions, and location of the central service work and storage area. The subjects which should be considered are:

(1) Flow of work
(2) Simplification of procedures
(3) Standardization of procedures.

Once the job has been outlined and established, the most economical way must be found for performing the operation. This can be accomplished by a time and motion study. Careful evaluation should be made of each situation. An attempt should definitely be made to eliminate unnecessary movements, to combine operations, and to arrange the sequence to improve the work pattern and simplify the necessary operations.



Shown above is a section of the mantel on wall where oxygen regulators are hung. Keeping a minimal amount of oxygen in central service saves personnel trips to the central storage area.

Left: Mr. Dawson, central supply attendant, loads one of two fully automatic sterilizers. Since reorganization, the central supply unit now packs and sterilizes necessary linens for surgery every day, as well as instrument packs and drums from dressing rooms and emergency room area.

Tools and materials should be processed and located in an area convenient and easily accessible to the person assigned to perform the procedure. Carts should be provided to deliver materials to the necessary area.

Our central service department is on the third floor, which is in the center of the hospital. Since the presently allocated area does not permit further extension of the department, the space devoted to activity is divided into three rooms. The special subdivisions are:

(1) Glove-cleaning and testing area
(2) Supervisor's area
(3) Glove-conditioning area, with the work area for assembling of glove packs
(4) Linen storage area, with the necessary tables for making packs
(5) Oxygen area
(6) IV fluid storage area.

The necessary equipment is stored in close proximity to the appropriate area.

Clean equipment and sterile equipment had been divided

Above: Mr. Fletcher, central supply attendant, is shown working at the glove-conditioner in central supply unit.

into two areas in the sterilizing room.

The necessary forms for current use on nursing divisions are stored near dispensing areas in small quantities adequate for the departments.

NEED TO PLAN STORAGE

Poor storage and distribution can be factors in the loss of motion and time. It is important to plan any storage and distribution system to make space available when needed.

An analysis has been made by the hospital of the various items used on the nursing stations and the frequency of their use. As a result, the items frequently used are located in easily accessible areas, and those needed less frequently are farther from the dispensing areas.

The quantity that is stored has been determined by a use analysis, drawn up on the needs for a 24-hour period. This system has reduced the time spent by the nursing personnel and doctors in waiting for fluid or general procedure trays. Additional intravenous fluids are stocked in the storage area directly adjacent to the present central service area.

SUPERVISOR'S QUALIFICATIONS

The supervisor must be a person of decision and leadership, with the ability to evaluate and analyze jobs and to supervise tasks. He must have a knowledge and understanding of the needs which are to be met by the department and the functions of the staff in relation to these needs.

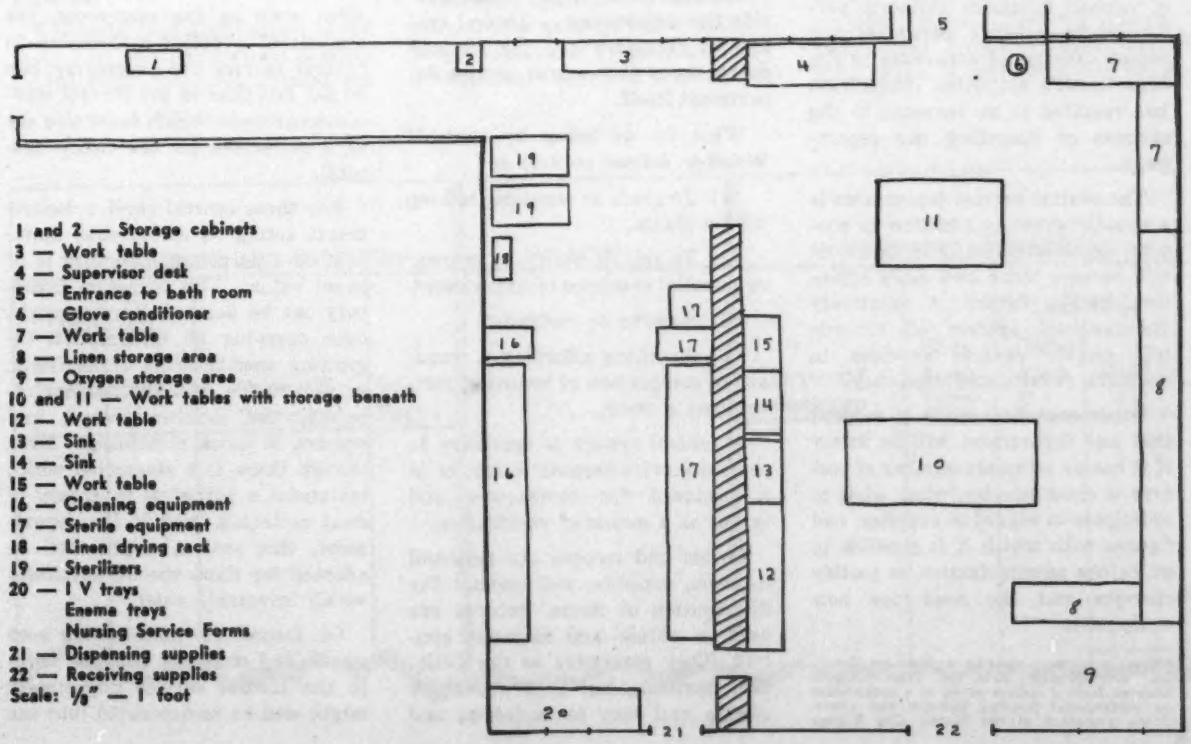
There is a constant need for teaching new methods, of cleaning, of preparing supplies, of operating the sterilizers, of assembling equipment, and of preparing general procedure trays. The supervisor skilled in work simplification and job assignment will eliminate many administrative problems. Every operation has three parts: preparation, assembly, and storage. The supervisor analyzes each step to achieve a method to complete the work safely and accurately.

Under our reorganization plan, the department has been equipped with many labor-saving devices, such as glove conditioner, a needle-sharpener, and two large automatic American Sterilizer autoclaves.

The interest of the department personnel has resulted in the effectiveness of the central service area. We have made a study of new methods in order to improve interdepartmental relations. Without the cooperation of department personnel and the nursing service areas, it would have been difficult to establish a program with such good interdepartmental relations.

The primary function of the central service department is to supply the nursing divisions and the departments throughout the institution with the type of supplies to effect better patient care. Although the department is relatively new and administrative problems have arisen, we feel that in due time many of these problems will be eliminated, and the service given by this department will be fully realized and appreciated.

Central Service Floor Plan



Control of Supplies

By Arlene Howe, R.N.*

• In today's hospital, the central service department has emerged as an indispensable department in the maintenance and improvement of patient care. Its importance has increased as administration and nursing have realized the assistance it can give in terms of service to nursing units, operating rooms, delivery suites, and other service departments.

Any planned co-ordination of effort that (1) increases productivity, (2) provides for better utilization of manpower, (3) leads toward more economical operation, (4) decreases time lapse between need and availability, and (5) develops a better understanding of responsibilities *should* lead to better patient care. We in central service should have this as our goal.

Centralization in central service of various functions formerly performed by nursing personnel has meant substantial expansion in the department's activities. Expansion has resulted in an increase in the expense of operating the department.

The central service department is a rapidly growing addition to hospital administration, and by merit will receive more and more attention in the future. A relatively standardized system of records will enable central services to compare results and efficiency.

Experience has made it evident that any department will do better if it has an adequate number of records to show who has what, what to anticipate in regard to supplies, and figures with which it is possible to go before administration to justify changes and the need for new equipment.

*Nurse consultant, research department, American Sterilizer Co., Erie, Pa. This article is adapted from a lecture given at a symposium on professional hospital technics and procedures, presented at the Boston City College

Hospital personnel all the way from the governing board to the aide have become "cost-conscious." Many hospitals have established commodity budgets within their various departments; some hospitals have established individual nursing unit commodity budgets.

With a concentration of medical and surgical expense in central service has come the problem of apportioning the department's cost to the various other units and departments that use its services. In hospitals which have such accounting practices it is imperative that records be kept of items charged to individual unit budgets.

In most hospitals some direct charges to patients are made by the central service department. Records must be kept to make such charges.

But regardless of any forces outside the department, a control system is necessary for the efficient operation of the central service department itself.

What do we mean by control? Webster defines control as:

(1) To check or regulate; to keep within limits.

(2) To test or verify by counter or parallel evidence of experiment.

(3) Reserve or restraint.

(4) Anything affording a standard of comparison or means of verification; a check.

A control system is necessary to central service because it results in a standard for comparison and serves as a means of verification.

Forms and records are essential to issue, expedite, and account for distribution of items. Records are used to obtain and maintain control. They may vary as the situation demands, but they should be simple and easy to maintain, and should be kept to a minimum. They should be of such a nature that it does not take a specialized person to keep them.

Different methods of control are required to meet these different needs:

(1) The need to maintain supplies for processing in central service.

(2) The need to maintain sterile supplies for distribution to individual units.

(3) The need to maintain supplies within the individual unit.

(4) The need to know who has what, and where.

Different hospitals have different systems for purchasing and storing materials processed in the central service department. If supplies are maintained by a separate department such as the storeroom, the amount of supplies maintained in central service for processing can be far less than in the central service department which must also act as a storeroom for the entire hospital.

For those central service departments acting as storerooms, maintaining a perpetual inventory is of great value. The perpetual inventory can be kept on Kardex cards, each carrying all information regarding specifications of the item, as well as the cost, the number received, the number issued, and amount of stock remaining. Even though there is a storeroom which maintains a perpetual inventory of most materials used in the department, this system might well be adopted for those special purchases which invariably exist.

Or, records for maintaining both sterile and unsterile supplies within the central service department might well be incorporated into one

form. This can also serve as a guide for location of items. The item is listed; in one column is indicated the numbers of the cabinet and of the shelf on which the unsterile item is stored; in a second column is listed the standard quantity of unsterile item to be kept on hand. In other columns the location and standard quantities of the unsterile item are indicated. (Figure 1).

Cabinets can easily be checked for needs by any classification of worker in central service, and appropriate requisitions written at this time. Other activities can be incorporated with this function, from cleaning the shelf to checking for length of sterility.

A properly controlled inventory, based on maximum usage, will aid in assuring an adequate amount of materials available without having excess supplies which will become outdated. In many hospitals, checking for outdated items is more often needed than checking in order to maintain adequate supplies.

The person issuing supplies throughout the day also can endeavor to keep those responsible for maintaining supplies informed of the approximate use, such as tray sets, so that they may be readily replaced.

The method of distribution to the individual unit has a direct bearing on the type of control adopted for maintaining supplies within the individual unit. An important factor is keeping the time limit between need and availability at a minimum. In many instances, the method of distribution which offers the best service to individual units is the method most conducive to accurate records for central service. Perhaps this is the reason that the quota or standard quantity system is practical.

When we discuss method of distribution to individual units, it becomes necessary to break down into various classifications the items furnished by central service. For instance, we know that a hypodermic needle does not merit the same type of control as a tracheotomy tray.

Central service items may be classified as follows:

(1) Supplies used and not returned to the department, such as dressings and all expendable items, either sterile or unsterile.

(2) Supplies used in quantities and returned to central service for processing, such as needles, syringes, gloves, and instrument sets.

(3) Sterile and unsterile items used for specific patients, such as therapeutic tray sets and suction machines.

Effective control of inventory or standards of quality, which includes proper rotation of supplies to insure a controlled length of sterility, is impossible when more than one organization or department is charged with the same duties. We all know that frequently requisitions are written on nursing units without any check of standard quantities. And how can we be assured that there is rotation of supplies when it is not the specific assignment of any individual? In hospitals in which it was believed the best of controls were exercised, sterile supplies have been found to be as outdated as one year.

It is recommended, therefore, that distribution and storage areas within the individual unit for supplies obtained from central service be the responsibility of central service personnel, particularly for those items whose quality is of primary concern.

The amount of expendable supplies, both sterile and unsterile, maintained on each unit will depend largely on need and available storage space. Standard quantities should be established. A one-day supply should be the minimum amount maintained, and the supply should be replenished at specific intervals.

REUSABLE SUPPLES

Delivery of supplies used in quantities and returned to central service for processing, such as needles, syringes, gloves, dressing instruments, and frequently-used treatment trays, is more effective when

Figure 1

RAW MATERIAL AND SUPPLIES				ITEM	PROCESSED SUPPLIES			
Location							Location	
Cabinet #	Shelf #	Type of Package	No. of Pkgs.		Type of Package	Std. Quantity	Cabinet #	Shelf #

handled in the same manner as delivery of expendable items. Standards can be established and maintained by the central service department.

There should be an adequate amount of supplies to offer efficient care to patients for a specified period of time, but not such quantities that reprocessing of outdated items becomes a major task.

Delivery of such items is preferably done once a day. This specifically applies to those items processed on a mass-production basis, such as needles, syringes gloves, catheters, irrigating sets and basins, drainage bottles, and perhaps enema and catheterization trays. The delivery schedule adopted has a very important relationship to the grouping of activities in the central service department.

Let us take, for example, the processing of syringes, needles, and gloves. By grouping these major departmental activities into "one-time-a-day" activities, we can produce the processed items more economically and without confusion. We eliminate the many "get ready" and "put away" times, and workers can become more proficient at actually doing the task.

A point which must be emphasized is that adequate materials must be maintained in circulation to insure fulfillment of the individual unit needs, regardless of the type of delivery service established. A major obstacle to maintaining a smooth flow of materials, in the processing procedure within the central service department and of processed items between central service and the individual unit, is an inadequate amount of supplies in circulation.

How many times have we had to wait for linen items from the laundry before we could finish our sterile packs or choose certain floors to "short" because we were out of such items as syringes or irrigating sets?

We should analyze carefully the amounts needed. For example, we are agreed that we should maintain a minimum of four times and preferably five times the maximum amount of daily linen needs in circulation—one being used, one being washed in the laundry, one being processed in the central service department, and one in transit between these areas.

Consideration should be given to all facets of a process to insure that proper precautions are being exercised to assure maximum economy. An additional day's supply of gloves should be in circulation so that proper storage practices can be carried out. Again, five times the maximum daily needs are recommended —one in use, one being washed and dried, one being tested, packaged and sterilized, one being held aside to regain tensile strength, and one in transit.

If items do not go to other departments for any part of the processing or if no extra precautions are necessary, a two-day supply should be sufficient to maintain an even work flow.

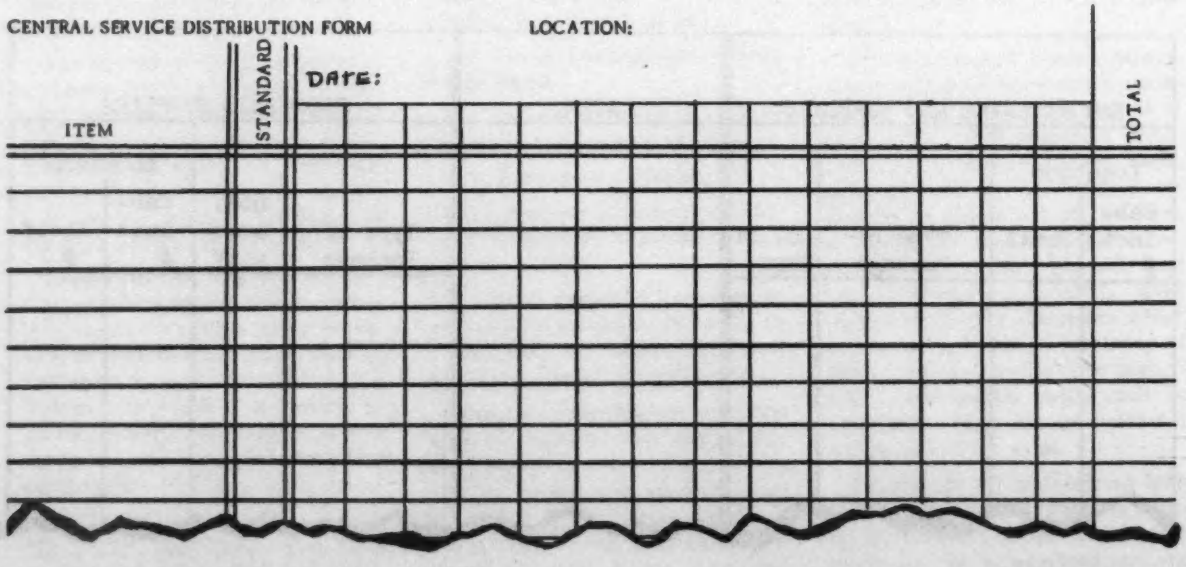
We should keep in mind that one goal of the central service department is to decrease the time lapse between need and availability and to make better utilization of manpower. Delivery of specific items should be co-ordinated with need and usage. Maintaining an adequate supply of materials within the unit to offer effective patient care will discourage hoarding.

Once the supervisor has gained the confidence of the various departments that she can and will furnish materials normally processed in central service as the need arises, hoarding will cease.

Standardized storage areas within each nursing unit are invaluable for such a delivery service. A well-stocked delivery cart, adequate in size but easily moved, is a must.

Records should be maintained of quantities left on the unit at each delivery. They will show the amount

Figure 2



used by the individual unit and, if charges are made to the unit, they may also serve as a record for such charges. The desired standard quantities for various items can be arrived at very quickly from a review of these figures. Standard quantities may have to be changed from time to time according to changing needs (see Figure 2).

Delivery of sterile and unsterile items used for specific patients can become a problem if there is no dumb-waiter service. Some central services are offering hourly delivery and pickup of such items.

Is this practical? Let's suppose that the department is offering service to 10 nursing units. Which is best, to assign one person from the central service department to make rounds to these units in an organized manner, or to have personnel from each of the 10 nursing units returning and picking up items at random—a system which requires the time of a person at the dispensing and receiving location? Regular deliveries also decrease the number of so-called "emergency deliveries."

An effective delivery service for requested items should be a part of the services rendered by the central service department, providing there is no other messenger service available. The frequency of such deliveries will be influenced by the types and amounts of items maintained in standard quantities on the individual unit.

Pickup of soiled items is as important as delivery in contributing to an efficient and safe operation. Many hospitals follow the practice of "even exchange," the exchange of a soiled item for a clean item. Frequently the delivery cart carries both soiled and clean items, and workers are simultaneously handling clean and soiled items without practicing proper handwashing technics, because there is neither the time nor the facilities.

What better way is there to spread the dreaded staphylococci or other contamination throughout the hospital? And what actual use is made of information collected on this exchange basis? In many hospitals the information is not even recorded.

A specific area within each nursing unit should be designated for the collection of soiled items, and of course an area should be designated for receiving processed items from central service. This principle of separation of clean and soiled items should also be kept in mind when using dumbwaiters for transportation of these items.

How does the department keep from losing items if there is no even exchange? Remember that two of the goals of the central service department are better utilization of manpower and more economical operation. These criteria should guide the supervisor in establishing her policies. The time spent in accounting for a lost hypodermic needle would soon far outweigh any savings derived.

The physical setup should be conducive to the return of items by providing a conveniently located specified area for the collection of soiled items. Co-operation of the staff in returning items to the specified area immediately following use is a vital factor in the control of losses.

The frequent delivery and pickup service is a great aid in the control of missing items. When used trays, for example, are returned promptly to the specified area and picked up promptly, there is quick recognition of missing items. Immediate followups may require only a moment, and they produce good results.

The delivery person is one of the department's greatest public-relations officers. She should be well informed of her responsibilities and the reason that these activities should be carried out. She must be tactful.

It is very helpful if the central service supervisor takes the time occasionally to go out with the delivery person. If the supervisor shows the various departments that she is interested in their problems, it is amazing how easily she can correct many problems once she recognizes they exist.

Any control system adopted must meet the needs of the particular hospital and fit into the structure of operation. The method of control should be discussed with the hospital administration and other persons in authority. A successful control system must have their backing.

Whatever procedure is finally agreed upon, with the special policies and limitations established, it is of supreme importance that the personnel of all departments involved, including the central service department, be fully aware of what is being done. They should be made to understand that checking is a business procedure and is not done solely because of distrust. The rules and regulations exist for only one reason—the welfare of the patient. Make this an inspiration for all. Appeal to their integrity.

Factual reporting helps to determine where losses occur. Get these facts from the department's records. Report missing items promptly to those in command, so that an investigation can be carried out if desired. Records will soon indicate whether missing items are being carelessly mislaid somewhere or whether pilferage is a problem.

It takes a mature adult approach to do the job at hand. Until the hospital accepts its problems, little progress can be made.

SUMMARY

Maintenance of records, establishment of a good delivery and pickup service with assigned space for each activity, formulation of policies and education of personnel to understand these policies, adherence to standard practices, and support from administration are all necessary for the proper control of supplies.

The hospital and its staff must have confidence in the control system, and feel that it is for better and more economical patient care. Once rapport is established, full co-operation can be obtained in all areas.

Sterile Supply Department

Constructed on Hospital's Rooftop

• The new sterile supply department of the Good Samaritan Hospital, Phoenix, Ariz., may have other hospital administrators looking skyward for extra space.

The modern layout blossomed on the roof of the hospital's existing four-story plant, after a fruitless search for necessary space elsewhere.

The sterile supply department processes and disburses all sterile materials for the surgery and obstetrical departments. In addition, it processes all rubber gloves for the entire hospital and supplies all sterile solutions of normal saline, distilled water, and procaine.

A central supply department is maintained on the first floor of the hospital. It has charge of sterilizing all syringes and all dressings and trays for ward and floor use. Inhalation therapy and suction equipment is issued out of this department.

Before the development of the sterile supply department, each hospital department did its own processing of supplies, with the inevitable result that many more personnel were needed to do the job. Also, it was not possible to standardize on sterile processing technics.

Under the present set-up, two registered nurses and 10 nonprofessional personnel (one orderly and nine nurses' aides) perform the work of the sterile supply department for the 314-bed, 44-bassinet hospital, which will have another 100 beds and 26 bassinets when the wing under construction is completed.

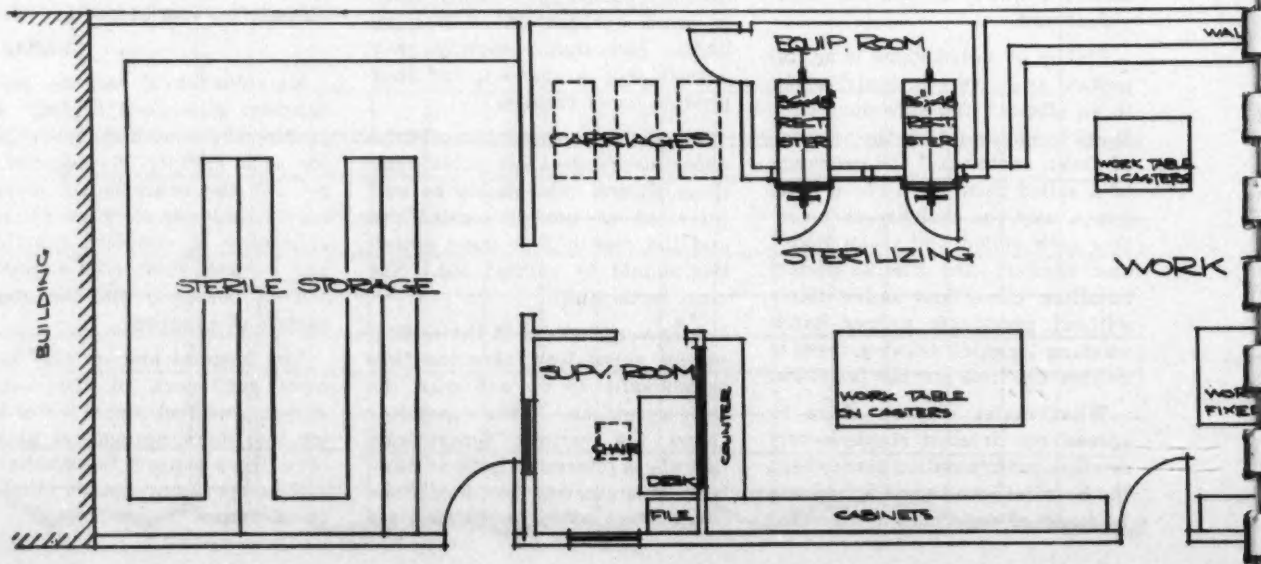
Department planning began with the necessity of adding to the hospital's overcrowded obstetrical department facilities.

Convinced that centralized sterilization and disbursement of supplies was the only solution, Administrator Guy M. Hanner took an inventory of available space, and it just wasn't enough. So he decided to build skyward.

The result is shown in the floor plan and photographs on these and the following pages. A spacious sterile storage area (see sketch) is set up at the outgoing end of the long, narrow rooftop department. Materials and supplies sterilized in the adjacent rectangular steam sterilizers flow directly to this storage area, with a minimum of distance and handling involved.

All department activities are under the direct supervision of Mrs. Evelyn Freeman, R.N., department supervisor, whose glass-enclosed office is strategically situated, yet screened from traffic and noise.

The incoming section, in which supplies are sorted, inspected, and otherwise prepared for sterile processing and storage, consists of ample work-table and counter facili-



Above: View of sterilizing and work room area. In glove room, at left in back of picture, is Mrs. Pearl Rice. Mrs. Shoup is in the flask room on the right. Mrs. Evelyn Freeman, R.N., department supervisor, is at lighted linen inspection work table in right center of picture. In the foreground, at the work table on the right, is Mrs. Marguerite Elsik, R.N., now associate director of nurses and formerly operating room supervisor.

ties, a flask room with wall-mounted still and 24-gallon capacity twin reservoir system, a modern glove-processing department, and a rest lounge for personnel.

There are five spacious work tables, largest of which are 5′ x 8′ One of these is illuminated from underneath by five 40-watt fluorescent tubes, making it easy to detect rapidly any defects in wraps for sterile bundles and other linens.

Three of the other four tables are mounted on casters, so that they can be relocated at a moment's notice to handle the work load at the most advantageous location. Each table contains drawers, to provide extra storage space.

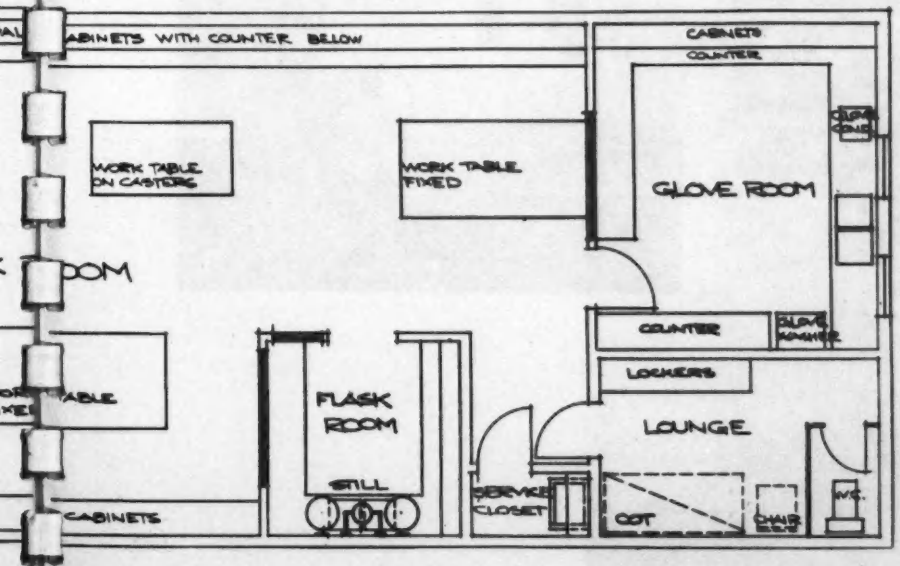
Both of the sterilizers are fitted with automatic control systems which actuate all the valving for the various cycle phases, as well as visibly timing the cycle and insuring a continuous correct exposure period for the type of load being processed.

With the use of these controls, sterilization of supplies can be confined to a routine which involves no more than the loading and unloading of the sterilizers. This is accomplished easily by lay personnel, under Mrs. Freeman's direction.

Supplies are taken to and fro by elevator. Surgery is on the fourth floor, and the obstetrical department is on the third floor. In the new wing, the obstetrical department will be on the first and third floors.

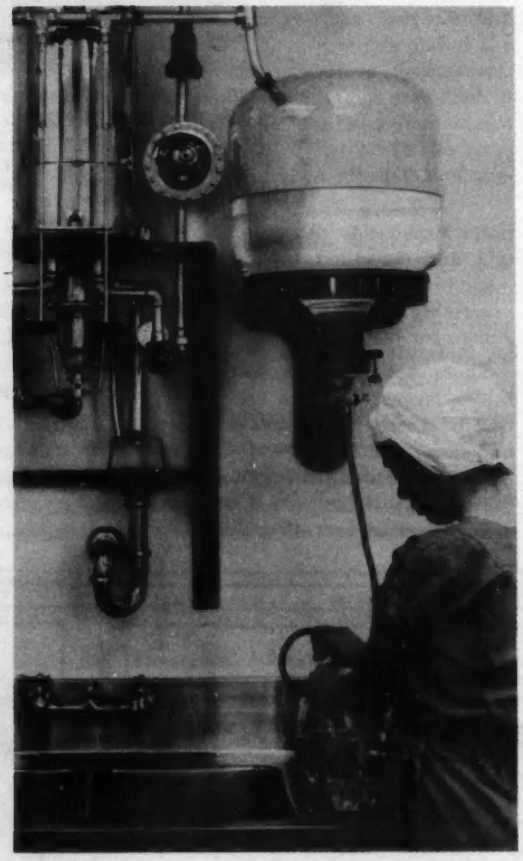
The division of labor between the sterile supply department and the central supply department works out very well, according to Mrs. Freeman.

An attractive color scheme helps make it pleasant for personnel to work in the sterile supply department. Walls and cabinets are pale pink. The tile around the autoclaves is a deeper pink. Ceilings are white. The work-table tops are of marbleized Formica, with a little pink in it. The vinyl tile flooring has a gunmetal background.

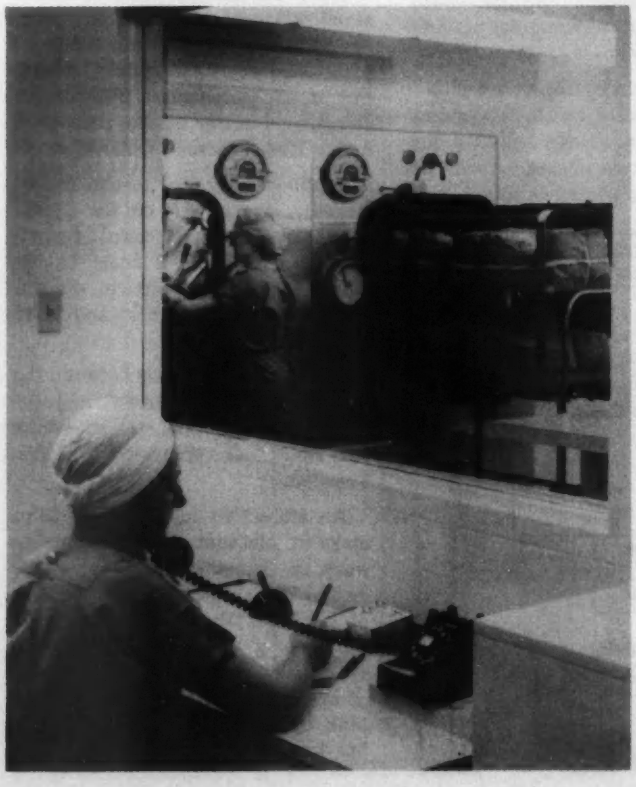


Above: Mrs. Schuler, R.N. (l.), delivery room supervisor, with Mrs. Evelyn Freeman, R.N., sterile supply department supervisor, at one of two large rectangular steam sterilizers. Materials and supplies, after sterilization, flow directly to the sterile storage area.

Below: Sterile solutions of normal saline, distilled water, and procaine for the entire hospital are made in the flask room, which has a wall-mounted still and 24-gallon capacity twin reservoir system. Mrs. Shoup is shown filling flasks.



Below: Mrs. Freeman has a private office, out of the flow of traffic, yet strategically located so that she can keep an eye on all department activities.



Above: One of large work tables (5'x8') is illuminated from underneath by five 40-watt fluorescent tubes. Ione Paasch, R.N., surgical supervisor, demonstrates how defects are readily detected when linens are placed on this lighted table. Department personnel liked the table so well that they had another one made—a portable, drop-leaf model.

Below: Rubber gloves for the entire hospital are washed, packaged, and sterilized in the glove room within the department. Mrs. Freeman here displays the automatic washer-dryer combination, which has proved effective and time-saving for washing and drying gloves. Between 150 and 200 pairs are processed daily.

Cooperation in Planning Promotes Smooth CSR Operation

● Asking many department heads for suggestions in planning the CSR department is a good way to help assure smooth operation and effective utilization of the department, in the opinion of Gladys Fisher, R.N., central supply supervisor, Huntington Memorial Hospital, Pasadena, Calif.

When active planning of the new, expanded department was started, the hospital administrator, Gordon W. Gilbert, gave Miss Fisher three weeks' relief so that she could work with the architect and concentrate on correlating ideas to be incorporated into the department.

She spent quite a bit of time at the drawing board, went to Los Angeles and inspected materials (at an architects' convention), visited central supply departments at other hospitals in the area, and asked other departments in her hospital what they expected of central supply and what they would like to have.

Suggestions from the departments were then brought up at a supervisors' meeting. Major issues were referred to the administration for decision.

One suggestion from the floors was that central supply furnish rectal tubes. At Miss Fisher's suggestion, disposable tubes have been adopted.

Employees in the central supply department itself were also asked for suggestions. Miss Fisher tried to keep their comfort in mind when planning. Air-conditioning, for instance, has thermostatic control in four different zones, so that employees can have the temperature they like in their area.

Asking for suggestions will be continued. Mimeographed forms describing new items stocked by the department—requesting opinions of personnel using them—will be solicited and opinions evaluated.

The basic plan of the department was supplied by the American Sterilizer Co. Changes were then made to suit the hospital's individual needs. Autoclaves were placed on an outside wall with louvered windows behind to allow for maximum ventilation and adequate light for good maintenance.

The department covers 2,250 square feet in floor space. Partitions have been used to divide the area into stations providing specific work areas where separate functions are performed. This permits work flow throughout the entire area from right to left.

Station 1 takes care of receiving and dissembly. Station 2 takes care of the glove processing — about 400 pairs each day. At station 3 approximately 750 syringes and 1,200 needles are processed daily. In stations 4, 5 and 6—the clean work areas—surgery and maternity packs and all material for patient use are prepared for sterilization.

At station 7 are two 26x36x48 stainless steel autoclaves and one 24x24x36, and one hot-air sterilizer. Adjoining the sterilization station is a comparatively small storage space for sterile materials. Only a 24-hour supply is kept in storage at a time.

Syringes and needles are distributed to all nursing units three times daily. Messenger service is provided every three hours between 7 a.m. and 11 p.m. Other services rendered are: distribution of appliances and electrical equipment, and of interdepartmental supplies for x-ray and laboratories; solution flasking, and sterilization of wash basins, bed pans, and other units used by the patients.

Oxygen equipment, orthopedic, and other heavy equipment kept in the department are issued through the orderly service.

The predominant color in the department is Miss Fisher's favorite—turquoise. There are turquoise plastic containers for small items, turquoise wastebaskets and turquoise Formica counter tops. Miss Fisher was told

At right: Inga Strand is shown at glove-tester in glove room. Instructions for glove-room procedures will include drawings on proper way to fold gloves for packaging in Sterilwrap.

Gladys Fisher, R.N., supervisor, at desk in office located in center of department. She is using a card file for recording purchases and consumption of supplies. The ordering for the department is done through the hospital central purchasing, and supplies are checked in by central receiving. Miss Fisher holds the prerogative of approving for quality, all materials used in her department.

Below: Lucille Irving checks procedure cards above sink in wash-up area. All cleaning procedures are listed, as is flow of equipment. Cards can be flipped upward on holder so that one needed is in view. Three procedure manuals are being set up—for various work stations. General sterilizing rules will be hung on cards in the autoclave area.

Inez Brownlow at paper-cutter. One of its uses is to cut Sterilwrap for separating glove cuffs. X-ray film and plastic used for protecting procedure cards are cut here. The cutter will be used for cutting labels to fit holders on shelving and drawers as needs arise.

F. G. Watson of maintenance department is shown in area behind sterilizers. Placing sterilizers on outside wall made an outside vent possible. Arrangement also makes it easy for maintenance personnel to get at sterilizers when servicing is required.

that she couldn't find turquoise Formica—but she did. The pleasing color in the sunny room against greyed raspberry walls makes a very cheerful working environment.

Formica was chosen instead of stainless steel for counter tops, back splashes, and table tops, except in areas in which there is plumbing, because it is easier to maintain, does not cause as much noise, and also was less expensive, Miss Fisher said.

White birch is used for partitions, cabinets, and work tables. The birch cabinets, built to specification, cost about half what stainless steel cabinets would have cost, the supervisor pointed out.

If she were doing the department over, Miss Fisher added, she would not put glass doors on the shelves in the sterile storage area, but would prefer closed shelves with contents not visible. The cupboards below the shelves with the glass doors have sliding doors of masonite.

The acoustical tile ceiling cuts down noise in the department. In addition to being well supplied with windows to admit daylight, the unit has recessed fluorescent lighting for the long night hours.

The top flooring is magnesium oxychloride, chosen because it is more resilient and light in weight.

Additional space will be available for the department for storage of unsterile stock items, when the obstetrical department moves to a new pavilion and turns over a room it has been using for teaching.

The expanded department has four times the amount of space it had formerly, when it was next to surgery. The former central supply area is now a 12-bed recovery unit.

With space expansion came also expansion of duties. Surgery and obstetrics personnel used to wrap and sterilize their own linens, because the sterilizing equipment in central supply was not adequate to handle the load. Now central supply does them.

The one dumbwaiter which services the department is not adequate, Miss Fisher says. However, she believes that many small items can be sent by the hospital's pneumatic tube system, which was installed early in 1957. In some instances, just changing the shape of a package may permit it to go through the tube.

There are two elevators just outside the department which are used for transportation of people and equipment.

The department, on the hospital's top floor, used to be a sun deck. A lounge and locker room for employees are being put in up one flight of stairs.

Miss Fisher is in the process of setting up a card file (a combination of a location file and purchase file on all items carried in the department). Quantity controls are kept on the same cards.

Procedure files, located at each work station in the department, contain photographs of trays and drawings of packs.

Personnel are rotated through the various jobs in the department—to keep them from getting tired of one job, and to make sure that all jobs can be adequately covered, even if someone is ill.

Miss Fisher, a former hospital administrator and obstetrical supervisor, has been central supply supervisor for the last eight years, and likes the department because it offers a challenge to her organizational ability and inventive talents. She is one nurse who is able, with technical assistance, to translate her ideas into equipment. She helped work out designs for a syringe-washer and a needle-cleaner introduced to the hospital market several years ago.

Her staff consists of 10 aides, three graduate nurses (including one as relief), and 10 orderlies. This number is expected to increase with the opening of the new maternity building and of additional patient rooms now under construction.

Eliminating Unnecessary Work In Central Supply

By Mrs. Jean Christie, R.N.*

Part I

• The greatest waste in industry results from useless, inefficient, and ill-directed motions, according to Frank Gilbreth, discoverer of the science of motion study. The marked resemblance of the central service department to industrial operations makes this a statement which each supervisor should study thoroughly.

It is known that the highest single cost of a central service is the cost of the labor to do the work. It is an inherent part of the job of any supervisor to make the most effective use of the time of the workers under her supervision, in order to do the work as efficiently as possible.

If the supervisor does not know the principles involved in performing work tasks well, she cannot fulfill her responsibility to the job, and she is wasting the wages paid for the labor, time, and effort of the employees who are performing inefficient and ill-planned tasks. To begin the study of such tasks calls for clear understanding of the terminology involved.

What is a job? A job consists of a series of tasks, which can be separated into three classifications: (1) the preparation or "set-up"; (2) the actual *doing* of the essential task, and (3) the clean-up or disposal of the finished product to make way for a new job. The word "job" is most commonly defined as "an individual piece of work done in the routine of one's occupation or trade."

What, then, is work? Webster defines it as the "exertion of strength to effect something," and from the study of this definition we find that work should have a definite purpose, and the exertion of strength can be mental as well as physical, can be easy or hard, simple or complex, productive or meaningless.

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*Central service supervisor, Free Hospital for Women, Brookline, Mass.

Henry Ford, Sr., observed, "Work consists of making some kind of motions. If we reduce the motions, we make it faster." Here is a new concept for those supervisors who have felt that the only way they could get more work done was to demand that their workers speed up their performance. This concept calls for elimination of any unnecessary motion from the task itself, which will reduce not only the time element, but also the expenditure of effort, thus making the task easier to perform. Even a superficial study of these basic elements of work will point out that we should seek to eliminate many of them from any job.

Seventeen basic motions were first delineated by Frank Gilbreth and are called "therbligs" (Gilbreth spelled backwards). The following listing is taken from *Motion and Time Study*, by Ralph Barnes:

1. *Search.* Refers to the hunting, by the eyes or the hands, for an object. (Why is the hunting necessary?)

2. *Select.* Refers to the choice of one object from among several. (Why is it necessary to have several objects together?)

3. *Grasp.* Refers to the contact of the object by the hands or fingers as they establish control of the object. (Could this be made easier or eliminated? Could the object reach its destination by sliding or dropping, or in any way other than actual pick-up?)

4. *Transport empty.* Refers to the movement of the empty hand toward or away from an object. (If this is a necessary motion, could we at least shorten the distance this empty hand must travel?)

5. *Transport loaded.* Refers to the movement of an object by means of carrying it, sliding it, or pushing against resistance. (Is it absolutely necessary to move this object from one location to another?)

6. *Hold.* Refers to retaining the object with no actual movement of the object taking place. (Is it necessary? How is it done? The costliest holding device of all is the worker's left hand.)

7. *Release load.* Refers to the release of the object. (This may be necessary or unnecessary, depending on whether the object has to be picked up again.)

8. *Position.* Refers to placing an object in such a way that it will fit its intended location. (Is this being done while the object is in motion, or does your worker make a separate step out of this?)

9. *Pre-position.* Refers to placing an object in predetermined position and location for its later use. (Have the workers been taught to do this, so that the next time they may need this object it will be easy to locate and grasp?)

10. *Inspect.* Refers to the examination of an object to determine whether it fits required standards. (Standardization of tools, supplies, and equipment could make many of these inspections unnecessary.)

11. *Assemble.* Refers to the placement of one object into or on another. (Could the objects be pre-assembled? Is the asembling being done the easiest way?)

12 *Disassemble.* Refers to the removal of one object from actual union with another (Why were they put together? Why must they be taken apart? How is it being done?)

13. *Use.* Refers to the manipulation of an object for the purpose for which it was intended. (This is THE necessary motion—all other motions are preparatory, supplementary, or unnecessary.)

14. *Unavoidable delay.* Refers to a

delay which the worker cannot control, such as the failure of a machine or process, or the enforced inactivity of the hands, while some other motion is being performed. (Could rearrangement of the steps in the process or the location of supplies, etc., remove this?)

15. *Avoidable delay.* Refers to delay caused by the worker. (Does the worker stop because the preceding steps are difficult to perform? Is there a break in the rhythm of the job which is disconcerting?)

16. *Plan.* Refers to the decision as to how to proceed with the job. (The supervisor should plan the job—not the worker).

17. *Rest.* Refers to the fatigue allowance which should be provided to permit the worker to recover from the fatigue which is incurred in his work. (Necessary—but requires understanding control.)

Given understanding of the basic motion, how does the supervisor group these motions together economically, to conserve the time and effort of her worker? She will gain guidance of great value from a review of the principles which industry uses.

The Principles of Motion Economy*

A Check Sheet for Motion Economy and Fatigue Reduction

These 22 rules or principles of motion economy may be profitably applied to shop and office work alike. Although not all are applicable to every operation, they do form a basis or a code for improving the efficiency and reducing fatigue in manual work.

Use of the Human Body

1. The two hands should begin as well as complete their motions at the same time.

2. The two hands should not be idle at the same time except during rest periods.

3. Motions of the arms should be made in opposite and symmetrical directions, and should be made simultaneously.

4. Hand motions should be confined to the lowest classification with which it is possible to perform work satisfactorily.

5. Momentum should be employed to assist the worker wherever possible, and it should be reduced to a minimum if it must be overcome by muscular effort.

6. Smooth continuous motions of the hands are preferable to zig-zag motions or straight line motions involving sudden and sharp changes in direction.

7. Ballistic movements are faster, easier and more accurate than restricted (fixation) or "controlled" movements.

8. Rhythm is essential to the smooth and automatic performance of an operation, and the work should be arranged to permit easy and natural rhythm wherever possible.

Arrangement of the Work Place

9. There should be a definite and fixed place for all tools and materials.

10. Tools, materials, and controls should be located close in and directly in front of the operator.

11. Gravity feed bins and containers should be used to deliver material close to the point of use.

12. "Drop deliveries" should be used wherever possible.

13. Materials and tools should be located to permit the best sequence of motions.

14. Provisions should be made for adequate conditions for seeing. Good illumination is the first requirement for satisfactory visual perception.

15. The height of the work place and the chair should preferably be arranged so that alternate sitting and standing at work are easily possible.

16. A chair of the type and height to permit good posture should be provided for every worker.

Design of Tools and Equipment

17. The hands should be relieved of all work that can be done more advantageously by a jig, a fixture, or a foot-operated device.

18. Two or more tools should be combined wherever possible.

19. Tools and materials should be prepositioned whenever possible.

20. Where each finger performs some specific movement, such as in typewriting, the load should be distributed in accordance with the inherent capacities of the fingers.

21. Handles such as those used on cranks and large screwdrivers should be designed to permit as much of the surface of the hand to come in contact with the handle as possible. This is particularly true when considerable force is exerted in using the handle. For light assembly work, the screwdriver handle should be so shaped that it is smaller at the bottom than at the top.

22. Levers, crossbars, and handwheels should be so located in such positions that the operator can manipulate them with the least change in body position and with the greatest mechanical advantage.

*Barnes, Ralph M., **Motion and Time Study.**

Part II

• The study of motions and methods, and applications of the principles of motion economy, apply to over-all production equally as well as they apply to small tasks and small details. If one were to study the "job" of the central service, it could be demonstrated that:

(1) The "set-up" of this job is the receiving, cleaning, and preparation of used supplies.

(2) The actual doing of the job is the sterilization of these prepared supplies.

(3) The "clean-up" concerns the storage, issuing, delivering, and recording of the sterile supplies.

This points out another concept—that the worker who performs the actual task of sterilization is the autoclave itself. It is as important to the total schedule of production to use the time of this worker properly as it is to use properly the time of any human worker within the department.

Scheduling of the preparation of supplies should be keyed directly to the availability of the autoclave, so that there is always a load ready for sterilization when the autoclave is ready to receive it.

The job of handling supplies following autoclaving will be far easier to systematize and control if the autoclave schedule has been so well planned that there is a definite regular pattern established for the time of unloading each autoclave. A frequent complaint of the supervisor is "lack of time for autoclaving," but before she requests the hiring of another person to extend this time, she must be sure that she is making the most productive use of the time currently available to her

It is not possible to review any job adequately without a clear-cut, systematic approach. The most important question to be asked is "WHY is the

job done?" It would certainly be a waste of the supervisor's time to discover all the means of reducing the expenditure of time and effort on any job if she concludes with the realization that the entire job could be eliminated, or could be done more economically by some other means.

Many supervisors persist in finding time and ways of doing the job of collecting, unknotting, and re-rolling used pieces of string, not realizing that the wage paid to the worker for the time consumed in this job is far more expensive than the price of a new cone of string.

The purchase of a specialized machine to perform one specific job, such as the washing of glassware, might release only a few hours per day of a worker's time, yet it is far less costly to pay the purchase price of the machine once than to pay the hourly wages of a person to do this job for the period of years the machine would last.

TIME-SAVING ITEMS

In recent years, we have seen the advent of prepared items, such as pre-wrapped dressings. It can easily be demonstrated that industry can and does wrap these dressings for less cost than the hospital expends on the wages of the worker to do this job.

It is probably true that the adoption of such time-saving items and machines would release less than eight hours per day of a worker's time and therefore would not allow the average hospital to "cut one full person from the payroll." But more important than this fact is that the release of the worker's hours would allow either the addition of some other job to his schedule or the performance of some extra service within the hospital. It is unsound economically to pay any wages for any unnecessary jobs, and if the administration and the supervisor would wholeheartedly devote themselves to a program of obtaining maximum productive use of each hour of a worker's day, they would then be assured that the hourly wage of each worker was fully earned rather than partially wasted.

The only sound answer to the question of "WHY is a job done?" is that the job itself cannot be eliminated or cannot be performed more economically any other way.

Having determined that the performance of a job is necessary, one should then determine WHAT the job is—where it begins and where it ends, what part of it is "set-up," actual doing, or "clean-up." Then she just proceeds further to question WHO does the job, WHEN the job is done, and WHERE the job is done.

TIME-FLOW CHARTS

If such a study of the job assures the supervisor that she knows precisely the nature of the job, and that it is being performed by the right person, at the right time in the schedule, and in the right location, she may then begin to consider the details of HOW the job is being done, and how the job *should* be done. Here the supervisor may use any of the much publicized tools of motion study, such as the "process-flow chart," the "man-machine chart," or even time study.

The one thing common to each of these charts is the necessity of recording in minute detail and in proper sequence every step of the actual performance of the entire job. This recording, in and of itself, may prove very surprising to the supervisor who believes she has planned this job efficiently.

The process-flow chart may show that she is requiring this worker to spend more time in travel to obtain or put away supplies than the worker spends in doing the job. The man machine chart may show that the worker is idling a great part of the time when the machine is working, or that the machine idles while the worker works. Time study, while it can be performed with an ordinary stopwatch, will be more accurate and more revealing if the supervisor learns to use a watch which is calibrated in decimal minutes rather than seconds, and which has a "snap-back" function.

Perhaps the most important "tool" which the supervisor has at her disposal is the cooperation she can obtain from her workers when they understand that she is attempting to make their jobs easier for them. She would be wise to begin with one single improvement which obviously makes a job easier for the worker—such as the placement of her glove dryer on a platform which raises the door of the dryer to the level of the worker's arm, thereby eliminating the fatigue incurred by constant stooping to the level of the machine when it is on the floor.

If the supervisor makes it clearly understood that she seeks to eliminate unnecessary jobs or motions, and unnecessary discomfort and fatigue from the performance of a task, she assures her workers that her concern is for them, and she will, in turn, be assured of high morale and sincere cooperation.

Influence of this sort can extend far beyond the central supply department. Thorough analysis of any job should also seek to eliminate any unnecessary work for the user of the prepared item. The catheter tray used in this hospital contains the top and bottom of a half-pint cardboard ice cream container, in place of the usual stainless steel solution bowls. Cotton balls are placed in the bottom of this container prior to sterilization.

The nurse using the tray pours her solution over the cotton balls, and discards each used cotton ball in the top of this container. When she is through, she puts the top and bottom together and discards the whole container.

This eliminates for her the jobs of discarding the waste and rinsing and wiping the bowls, and eliminates for the central service aide the need for keeping track of these bowls and the additional cleaning of them prior to repacking the catheter tray.

This extremely simple example of time-saving later produced an unexpected and highly desirable dividend. When the procedure and the equipment for the performance of perineal care was reviewed, one head nurse had become so thoroughly interested in the efficient performance of a job, that she was able to suggest that any kind of container, cotton balls, etc., could be eliminated by the very simple use of a plastic spray bottle, such as is commonly used for deodorant sprays, for the application of the antiseptic to the perineum.

The ultimate purpose of a central service department is improved patient care. This is accomplished by the careful supervision of proper sterile technics, and the exchange of nursing time formerly devoted to the preparation of supplies for additional time at the bedside of the patient.

The most effective job of service is the desire of every supervisor. The most efficient and most economical ways of preparing supplies or giving service will be discovered only by that supervisor who conscientiously seeks to eliminate the waste of supplies, effort, time, and money, from the performance of any job within her department or under her direction.

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Proper Positioning of Supplies in the Autoclave

By Dorothy W. Errera, R.N.

● The sterilizer operator needs an active imagination and solid grasp of a few fundamentals to load a sterilizer carriage in such a way that all the supplies will be sterilized.

Steam sterilization is a dependable, predictable process —an excellent method of destroying bacteria which demands but a few conditions for effective performance.

Two factors are necessary for sterilization by steam —heat and moisture—and both of these are provided by the steam itself. Steam as it contacts the cold surfaces of a load condenses, and in doing so wets that surface and heats it—much the same way the steam from a boiling kettle will condense on the cold kitchen wall, leaving it wet. The sterilizer operator must make it possible for this process to go on on all surfaces of every article to be sterilized.

Steam destroys bacteria by direct contact only. Successful bacteriologic action depends upon free access of steam to all surfaces in sufficient quantity to heat and moisten. The natural barrier to this process in the sterilizer is air—air in cans, air in tubes, air in the sterilizer.

Air and steam do not mix. Air is heavier than steam and pools in any hollow possible. Clearance of air from the sterilizer is accomplished by gravity through the air and condensate discharge line (see Figure I on page 23). The exit is the small, screened hole located in the bottom front of the sterilizer. The exit is blocked when that screen is full of dirt and bits of rubber bands, paper bags, etc. It should be unscrewed from its position and cleaned at regular and frequent intervals.

Air will also run out from jars, cans, bottles, or other hollow vessels in the sterilizer, provided the means for its escape are provided.

A useful imaginary check for the sterilizer operator is one in which she mentally substitutes water for air. If she can visualize the articles on the sterilizer carriage filled with water and will position them so that the water can only run out, she can be sure that air will also escape. By providing this horizontal path for the escape of air, she makes it possible for steam to contact the inner surfaces of these hollow vessels.

When it is impractical to sterilize a vessel in anything but an upright position, or when air clearance is difficult, as, for instance, from the lumen of a hollow needle or the inside of an Asepto bulb, another feature of steam sterilization can be used to make sterility of that remote surface possible.

This is the fact that when 1 cc. of water is heated to the boiling point, 865 cc. of steam is created (see Figure II on page 24). This information is useful for the operator faced with the problem of sterilizing syringe canisters which cannot be placed on their sides, or flasks which cannot be inverted. One cc. of water left inside that canister or flask will turn to 865 cc. of steam and force the air from that can or flask so that the inner surface is exposed to saturated steam.

Similarly, when suction tubing, Asepto bulbs, catheters, or needles are flushed with distilled water immediately before sterilization, a film of moisture is left which is heated and turned to steam to force air out.

Why distilled water?

Because tap water in most localities is hard—that is, it contains mineral salts which accumulate as a dry crusty layer.

These are examples of steam exerting a surface effect —contacting a cold surface, condensing, wetting, and heating.

This same action goes on when steam must penetrate a porous object to reach its contents. It heats and wets from the outer permeable surface through to the center. What steam will penetrate may well be answered by the question—what will water soak through? If water will run through a material, it is reasonable to say that steam will also get through at a rate sufficient to sterilize the contents.

The sterilizer operator can evaluate her sterilizing wrappers by simply making a sack of one, filling it with water, and watching the rate with which the water soaks through. It must not only be permeable—that is, let steam pass through—but must be enough so that penetration is accomplished in the time allotted for the sterilizing cycle. Water-proof paper, water-proof duck, and other materials made to keep water out will most certainly not let steam in rapidly enough to be effective.

Even with permeable wrappers and proper positioning of supplies, sterilization can be frustrated by loading— that is, literally LOADING a sterilizer carriage! Carriages so densely packed that force is needed to close the sterilizer door deliver unsterile supplies. Supplies

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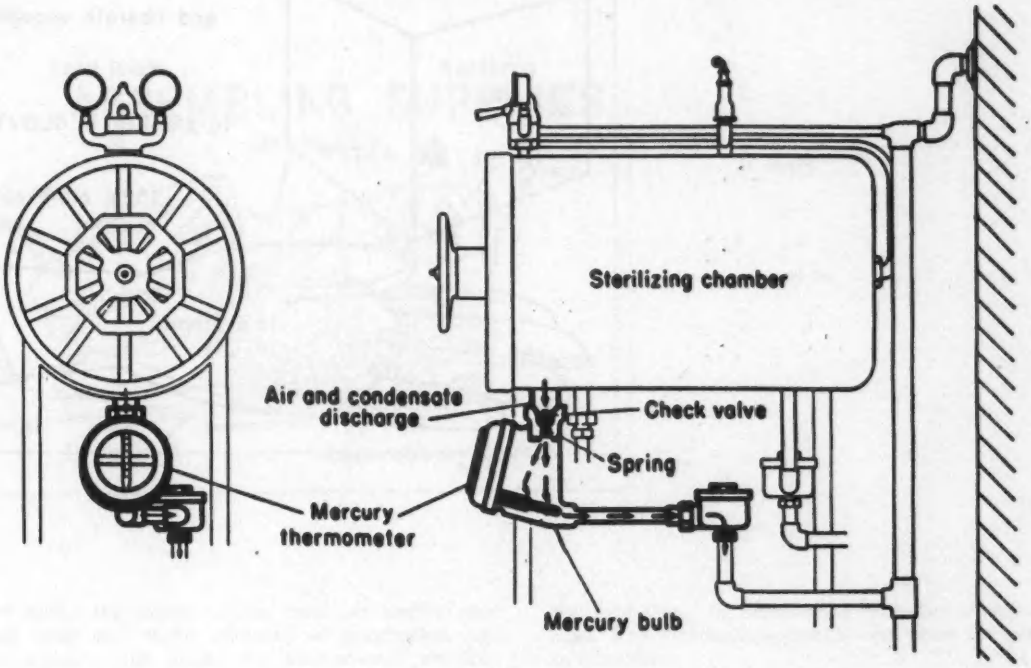
Illustrations for this article are from **Aseptic Treatment of Wounds** by C. W. Walter, M.D.: The MacMillan Co., 1948.

THERMOMETRIC CONTROL OF STERILIZATION



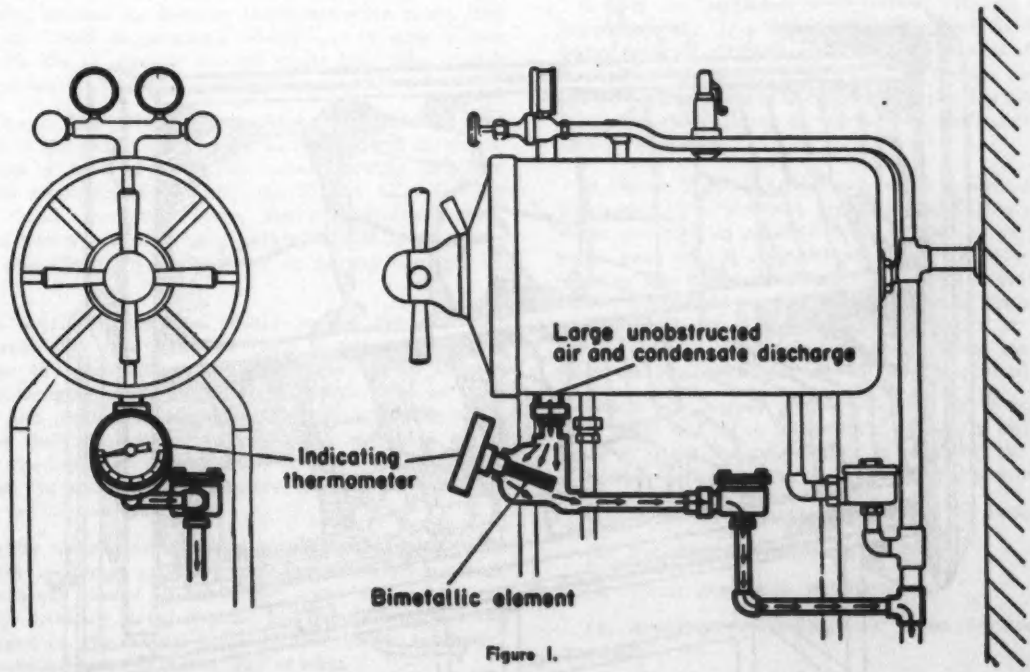


Figure 1.

Figure II.

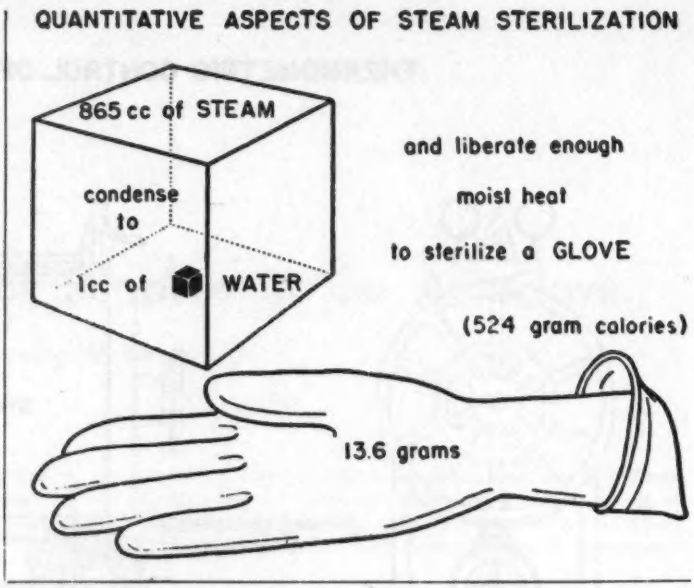
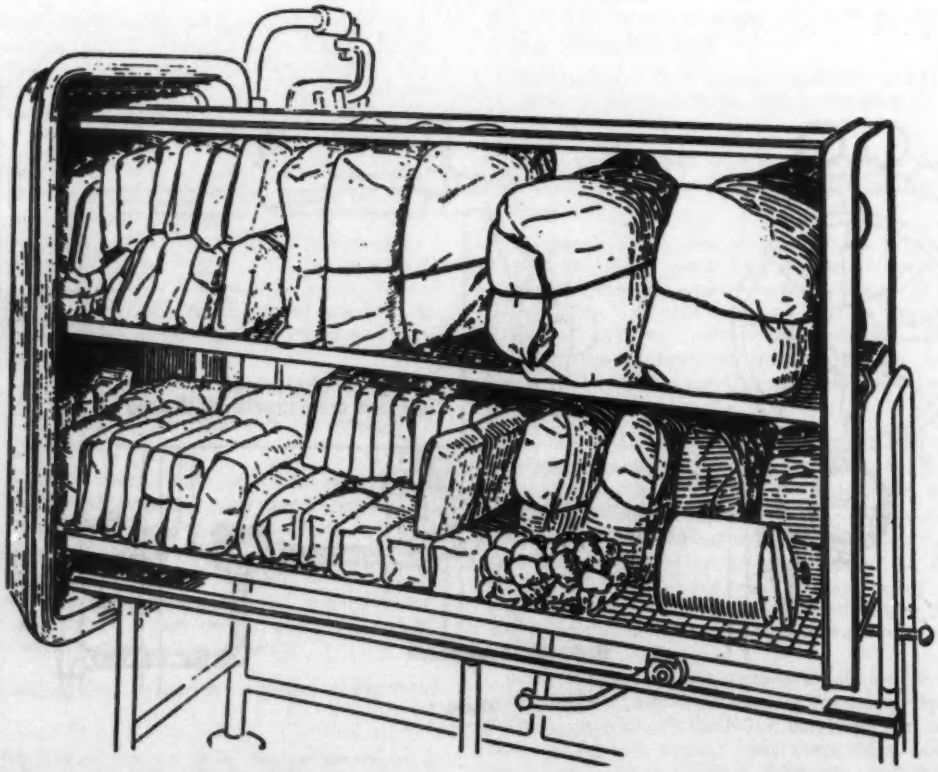


Figure III.



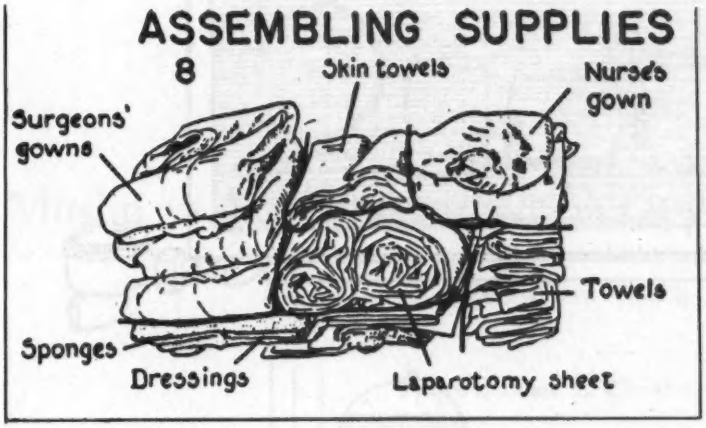


Figure IV.

packed under the weight of the load are tightly compressed, trap air, choke channels of penetration, and escape contact with steam. An open-shelved sterilizer carriage (see Figure III on previous page) guards against overloading, because tight packing is impossible—inasmuch as anything that is not free-standing simply falls off.

Large packs of dry goods are problems in penetration and heating. The size should be limited to that which has been studied for heating and penetration times. The contents should be arranged loosely and in such a way that the kit is actually several small kits. This makes for quicker heating and penetration.

A large, heavy laparotomy sheet, loosely rolled and placed in the center of the pack as two upright cylinders, provides a port of entry for steam flowing into the various segments of the kit (see Figure IV). On the other hand, the same large, heavy laparotomy sheet folded into a rock-like handkerchief is difficult to penetrate and effectively blocks steam on its way through the kit.

The sterilizer operator should survey the sterilizer load critically with these few facts in mind. She should picture the possibilities for free exchange of air and steam, imagine steam contacting all surfaces to be sterilized, and position dressing cans, suture jars, test tubes, etc. on their sides with lids removed. It makes no difference whether they are oriented to the back, front, or side of the sterilizer—the concern is for that horizontal path for the escape of air.

Tightly nested basins should be repacked, separated by a towel or sponge so that steam can reach all surfaces. Instruments should be sterilized unlatched—not in an untidy, unwieldy, tangled mess, but merely unlocked and arranged on instrument hooks so that steam can reach the remotest part of boxes and catches.

Rubber gloves challenge attention to detail. In the sterilizer, there is only one position in which they can be sterilized—that is, horizontally with the thumbs uppermost. Any modification creates conditions for incomplete sterilization.

If they are sterilized in piles, the bottom packages are compressed and escape contact with steam; if they are sterilized in a vertical position with the fingers down, the whole gloves trap air which can never run out.

If they are sterilized in a vertical position with the fingers up, the inner surfaces are exposed to dry heat, which requires a longer time for sterilization. As steam enters the sterilizer, it contacts the outer surface of the glove first and heats and wets it. By the time steam seeps into the glove, it meets a heated surface and cannot condense.

In Figure V, the fish tank represents a steam sterilizer. The water filling the tank represents air in the sterilizer. When the cork is removed from the discharge line, the water runs out. It obviously pools forever in the upright dressing can and capped flask; it clears but only tardily from the inverted suture jar and dressing drum (represented by the petri dish with holes placed to simulate the openings in a dressing drum). It runs out quickly from the can positioned on its side, uncovered.

Steam will destroy all bacterial life in 15 minutes at 250° F. It will do so consistently, efficiently and economically if given the opportunity to reach all the material it is expected to sterilize. This simple need is provided by:

(1) Proper positioning to allow for an escape of air

(2) Avoiding tightly fitting surfaces

(3) Using permeable wrappers

(4) Avoiding overloading and dense packing of the sterilizer

(5) Providing the moisture necessary to create steam in those situations in which penetration or gravity clearance is impossible.

WATER ANALOGY OF STEAM STERILIZATION

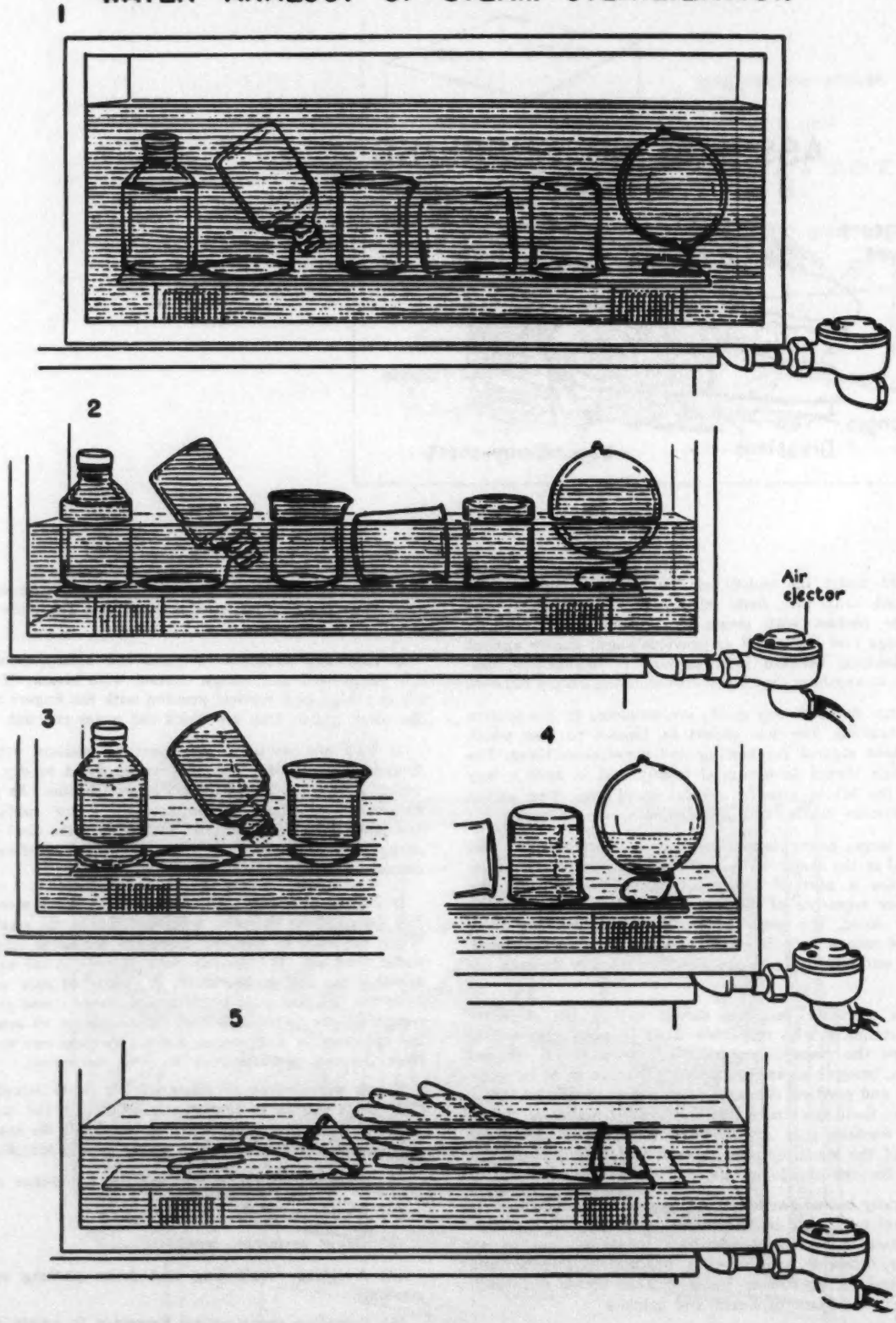


Figure V.

Muslin vs. Paper Autoclave Wrappers—A Hospital Study

Part I and Part II

By Mrs. Jean E. Christie, R.N.*

● Incomplete and conflicting data on costs per use of any type of wrapper, and conflicting statements of sales representatives concerning specifications and safety of wrappers, prompted a study at the Free Hospital for Women to determine which type of wrapper is best qualified to perform the job required, most easily, most efficiently, and most economically.

The goals of this study were:

1. To select acceptable and representative types of paper wrappers for testing.

2. To limit the sizes to be studied, the types of items to be wrapped, and the number of uses for each wrapper, in order to reduce the possibility of variable factors.

3. To determine the average number of uses which can be expected from any type of wrapper.

4. To determine the handling cost per use for each type of wrapper, including time study of inspection, sorting, folding, wrapping, repairing, etc.

5. To obtain by questionnaire a record of the opinions of personnel using these wrappers, concerning ease of handling, type of closure, the noise factor, personal preferences, etc.

6. To note the intangible costs, advantages, or disadvantages which might appear during the testing.

7. To test the safety of each type of wrapper under average conditions of shelf storage, with regard to fungus, aerobic and anaerobic bacteria for a period of not less than 90 days.

8. To obtain the cost-per-use of the muslin wrapper now in use, including the cost to manufacture the finished wrapper, and the cost of handling.

9. To compare the cost factors of the muslin wrapper with the cost factors of the best qualified paper wrapper.

Results of the study follow.

1. The selection of acceptable and representative types of wrappers.

Survey of the available literature and the surrounding hospitals revealed three basic types of paper wrappers in use: parchment, flat Kraft paper, and creped Kraft paper. Densometer readings were obtained on all papers. (This is a measure of porosity, indicating the time required for a given volume of air to pass through the sheet. Readings were obtained by Procedure D 726, American Society for Testing Materials.) The selection of wrappers to be tested included:

(1) Mill Crepe Kraft, a good quality Kraft, free of impurities such as dirt, foreign bodies, or pieces of undigested bark. (These would constitute a sterility hazard, since they could be so easily dislodged, leaving a hole.) Densometer reading: two seconds. This paper has been creped to provide some stretch and bleached white. It is generally believed that the bleaching process lowers the strength of paper.

(2) 2-way Crepe Kraft—a good quality Kraft, free of impurities, natural color, creped and then embossed to provide a two-way stretch. Densometer reading: two seconds.

(3) Flat Kraft—a brown sheet, 25 lbs. Densometer reading: 128 seconds. This sheet has a very low sulphur content and therefore should not darken chrome-tipped or plated articles.

(4) Parchment—a flat white sheet of vegetable origin. Contains water-soluble softener. Densometer reading: 2,300 seconds. Because of the high densometer reading, preliminary testing to determine the adequacy of steam penetration was done before we accepted this parchment.

2. The scope of the study.

The size chosen to be studied was the 25″ x 25″ sheet which would permit the wrapping of linen packs, trays, sets, metallic objects with rounded or sharp edges, and objects of odd shapes. The simple device of labeling on the wrapper each time it was used, gave us a constant check on the condition of the types of wrappers as they were used.

Testing of these papers for linen wrapping and for trays and sets was of little value. We very quickly found marked advantages of a creped product for problem objects, such as the irrigating can with its tubing, the surgery "prep" set with its large emesis basin and the handles of the

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ring forceps protruding from this basin, and the large transfer forceps jar with the long dressing forceps protruding.

Parchment and flat Kraft were discontinued for this use, and a further study of the use of the creped papers with other problem objects was begun. This study effectively proved the greater handling ease of the Kraft which had been both creped and embossed, providing a two-way stretch.

3. Determination of the number of uses of each wrapper.

As mentioned above, this department used the device of labeling directly on the wrapper for each use of the wrapper. The optimum number of uses for each type was determined not only by those who were using the papers in wrapping and sterilizing, but also by those who were using the sterilized items in the surgery and nursing units. After six months of testing, the following decisions were reached:

Parchment—optimum: one use. Maximum: three uses. Reason given: marked loss of the softener in this type of wrapper produced a product which became far too stiff, too wrinkled, and too noisy for use. This was reflected in increased difficulty in wrapping, inspecting, and sorting, and in unwrapping because of the parchment's tendency to spring back to the folded shape.

Kraft—optimum and maximum: one use. Reason given: Increased difficulty in wrapping, unwrapping, inspecting, and sorting. Special attention was given to the actual damage to the fibers of this paper during creasing and folding, even on its initial use.

Mill crepe—optimum and maximum: one use. Reason given: This hospital uses autoclave tape as its approved method of closure. Removal of this tape, no matter how gently, tears fibers of this crepe paper, resulting in a weakened area or an actual hole.

2-way crepe—optimum: six uses. Maximum: still being studied. Reason given: This paper becomes softer with each autoclaving and shows little change in other characteristics. After eight uses, the natural color has darkened sufficiently to produce difficulty in readings labels on it.

No difficulty was encountered in any department concerning the return of this paper to central service for re-use—partially due to the fact that each department has a designated place for the used wrappers

Comparison of Handling Times, All Wrappers

	Size 15" x 15"				
Time is recorded in 1/100ths of a minute	Muslin	Mill Crepe	Parchment	Kraft	2-way Crepe
Inspection and Sorting					
1. Pick up pile of wrappers and place on table	.004	.004	.004	.004	.004
2. Pick up, unfold one wrapper	.003	.002	.003	.003	.002
3. Inspect	.005	.003	.005	.004	.003
4. Refold	.002	.....	.....	.....	.....
5. Place on pile	.003	.002	.002	.002	.002
6. Place pile on shelf	.006	.005	.005	.005	.005
Graded Time Total per wrap	.01218	.00718	.01018	.00918	.00718
Wrapping					
1. Pick up wrappers, unfold and place on table	.007	.005	.005	.005	.005
2. Place item in center of wrap	.003	.003	.003	.003	.003
3. Wrap item	.021	.016	.019	.018	.016
4. Tape package	.005	.005	.005	.005	.005
5. Label package	.007	.006	.006	.006	.006
6. Place package aside	.006	.006	.006	.006	.006
7. Replace unused wrappers	.007	.005	.005	.005	.005
Graded Time Total per wrap	.04228	.03620	.03920	.03820	.03620
Labor Costs (@ .01460 per minute)					
To inspect one wrapper	.00180	.00105	.00150	.00135	.00105
To inspect 50 wrappers	.09000	.05250	.07500	.06750	.05250
To wrap one item	.00630	.00540	.00584	.00570	.00540
To wrap 50 items	.31500	.27000	.29200	.28500	.27000

which is easier to reach than the waste can, and to the numerous opportunities for thorough communication with each department concerning these wrappers. Bacteriological testing performed on wrappers of this type which had been used 10 times produced negative results consistently.

4. Determination of handling costs.

Handling costs were determined by the use of time study, industrial method, using a watch calibrated in decimal minutes rather than in seconds. In many cases, the unit of time was so fine that it was necessary to define it by checking it in combination or group of motions, for which the time had been previously determined. Any time unit less than .004 (4/100ths of a minute) has been obtained by this method and its accuracy checked and rechecked.

The following is a reproduction of the time units involved in each step, as obtained from observing actual performance of handling each type of wrapper under exactly the same conditions, the only variable factor being the texture and characteristics of each type of wrapper. It should also be noted that the types of wrappers were never introduced in the same order during testing, so that the worker could not build up a rhythmic pattern in shifting from one type to another.

The inclusion of muslin in this comparison of time units and costs shows one great difference in the handling of this material. Only the small-size muslin wrapper can be laid flat on the average storage shelf; the two larger sizes must be refolded carefully or they will become so wrinkled that their appearance is ruined. Large-size paper wrappers, however, can be piled and the entire pile folded over once, with no effect on their appearance.

Therefore, in the wrapping technic, it is necessary to reach for, unfold, and place each individual muslin wrapper. With paper, however, the worker reaches for the folded pile of wrappers, and can unfold and place the entire pile in one handling.

In the study of inspection of wrappers, it was observed that a hole can be detected more readily in brown papers than in muslin or in white papers. The translucent quality of the parchment proved to be a hindrance rather than a help. The creped papers, again, proved easiest to handle and smooth.

Muslin was studied very thoroughly, with surprising results. Since the use of pins to secure wrapped items has been discarded generally, the usual damage to the muslin wrapper now is in the form of a tear through both layers or a break in one or more individual threads on one side only.

Size 25" x 25"					Size 40" x 40" Projected Figures				
Muslin	Mill Crepe	Parch-ment	Kraft	2-way Crepe	Muslin	Mill Crepe	Parch-ment	Kraft	2-way Crepe
.004	.004	.005	.005	.004	.005	.005	.006	.006	.005
.003	.003	.005	.005	.003	.004	.004	.006	.006	.004
.005	.004	.006	.005	.004	.006	.005	.007	.006	.005
.006	.....	.....	.....	.....	.011	.....	.....	.....	.....
.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
.006	.005	.005	.005	.005	.006	.005	.005	.005	.005
.01720	.01018	.01420	.01320	.01018	.02422	.01220	.01622	.01522	.01220
.010	.005	.005	.005	.005	.016	.005	.005	.005	.005
.004	.004	.004	.004	.004	.005	.005	.005	.005	.005
.029	.020	.027	.026	.020	.039	.026	.033	.032	.026
.006	.006	.006	.006	.006	.006	.006	.006	.006	.006
.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
.007	.007	.007	.007	.007	.008	.008	.008	.008	.008
.....	.005	.005	.005	.005	.....	.005	.005	.005	.005
.06100	.04420	.05120	.05020	.04420	.06532	.05220	.05920	.05820	.05220
.00255	.00150	.00210	.00195	.00150	.00360	.00180	.00240	.00225	.00180
.12750	.07500	.10500	.09750	.07500	.18000	.09000	.12000	.11250	.09000
.00915	.00660	.00765	.00750	.00660	.00975	.00780	.00885	.00870	.00780
.45750	.33000	.38250	.37500	.33000	.48750	.39000	.44250	.43500	.39000

Report on Autoclaving Wrapper Comparisons

Score each paper by placing a check mark under the APPROPRIATE number. 1—Good, 2—Average, 3—Poor.	Kraft			Parchment			Mill Crepe			2-Way Crepe		
	1	2	3	1	2	3	1	2	3	1	2	3
Before autoclaving:												
1. Which surface texture is the most pleasing?			√			√		√			√	
2. Which color is the most pleasing?	√				√			√		√		
3. Which paper is quietest?			√			√		√		√		
4. Which paper is softest?			√	√			√			√		
5. Which paper is most resistant to tears?			√		√			√		√		
6. Which paper is easiest to inspect?			√			√	√			√		
7. Which paper is easiest to sort?			√			√	√			√		
8. Which paper is easiest to use for wrapping?			√			√		√		√		
9. Which paper is easiest to use for wrapping curved or round objects?			√			√		√		√		
After autoclaving:												
1. Which paper dries fastest after autoclaving?	√					√	√			√		
2. Which paper softens with repeated use?			√			√		√		√		
3. Which paper unwraps most easily?			√			√		√			√	
4. Which paper is the quietest?			√			√		√		√		
5. Which paper has less change in color after repeated autoclaving?	√				√			√		√		
6. Which color is most pleasing?	√				√			√		√		
7. Which paper is easiest to inspect after repeated autoclaving?			√			√		√		√		
8. Which paper works best with autoclave tape?			√			√			√	√		
9. Which paper provides the packages which are easiest to store?			√			√	√			√		
10. Which paper seems most satisfactory?			√			√		√		√		

Please write your own comments about each paper below:

	Chief Advantages	Chief Faults
Kraft:	None	Paper cuts Difficult to unwrap Noise a real problem Tears easily
Parchment:	None	Paper cuts Difficult to unwrap Noise a real problem Tears easily
Mill Crepe:	2 preferred the white color	Difficult to unwrap Becomes dirty-looking Tears easily
2-Way Crepe:	Easier to use More durable Stores and handles best Easy to use with autoclave tape Piles of wrappers stay on slanted shelf Easier to inspect	Difficult to unwrap large items

Since all authorities agree that two layers of muslin are required to insure safety of the sterilized package, it follows that a break even in one individual thread is a hazard to sterility which is not to be tolerated.

In a study of 25 wrappers, all of which had a definite break in an individual thread, only 11 of these breaks could be seen when inspection was done by daylight through a window; only 13 of the 25 were discovered when inspection was done by holding the article in line with a ceiling light.

Only two of the eight people who inspected these wrappers ever discovered the break in the 25th wrapper—and then only by carefully inspecting it on both sides with full light on and through the material. It would appear that the safety of the muslin wrapper might also be very much open to question, and that perhaps we should build an inspection window in our linen tables, adequately lighted above and below, so that we may safely inspect this wrapper.

With regard to the time and cost of repairing these wrappers, it was noted that a paper wrapper could be cut into useful pieces and the torn part of it discarded, in .010 minutes, at a cost of .00150. Since this figure was based on all types of paper wrappers, and on all sizes, it is used as a consistent handling cost for all papers hereafter.

5. Opinions of the personnel.

A questionnaire was sent out to all surgery and central service personnel concerning various factors in the handling of these papers before and after autoclaving. Muslin was not included in this questionnaire, since its aim was a factor comparison of the paper qualities. Results are shown in the accompanying chart.

6. Intangible costs, advantages and disadvantages

Storage: Approximately three times as many paper wrappers can be stored in the same area as the comparably sized muslin wrappers. The two percent storage figure levied as a charge against the muslin wrapper is thereby considerably reduced for paper. Storage of new wrappers, in cardboard cases, is far more easily accomplished than the storage of muslin bolts or partly prepared wrappers in the sewing room.

From the time of receipt of the paper wrappers, only one storage location is necessary until their issuance to central service. Muslin wrappers require several interdepartmental transportations, each in turn requiring temporary storages for these wrappers.

Supply: The level of work done by the sewing room is high enough to preclude the possibility of keeping a supply of new wrappers ahead. When an order for new wrappers is placed by the central service, the routine of work is interrupted and delayed, in order to turn out these wrappers as fast as possible.

In the event of any accident to the

The complete time-study observation sheet reproduced below shows the entire method by which the time studies have been done, with regard to the time itself, the grading or leveling, and the method of determining the cost of the job.

Time Study Observation Sheet

Date: 10/29/56 — Sheet No. 189

Operation: Repair Muslin Wraps Patch 1" x 2" — Time: .078 per 1 — Operator: MC

Reason: Determine cost — Location: Sewing Rm — Job Rate: .019 — Supervisor: MM

Start: 12:30 pm — Stop: 12:35 pm — Total: 4.042 — Cost: .01482 — Observer: JEC

No.	Detail of steps	Cycles 1	2	3	4	5	Average time Mach	Man	Set Up	Grade
1.	Set up materials	.048	.....	.....	.....	.....	.....	.....	.048	.....
2.	Pick up wrap, find hole	.056	1.014	1.076	2.048	3.031	.....	.010	.....	.....
3.	Place wrap on machine	.063	1.022	1.094	2.060	3.040	.....	.011	.....	.....
4.	Pick up patching material	.065	1.025	1.098	2.075	3.047	.....	.006	.....	.....
5.	Clip, tear patch. Drop cloth	.068	1.028	2.002	2.083	3.056	.....	.005	.....	.....
6.	Fold and place patch	.072	1.034	2.009	2.091	3.064	.....	.006	.....	.....
7.	Sew	.093	1.064	2.033	3.015	3.085	.....	.024	.....	.....
8.	Clip threads, drop wrapper	.097	1.068	2.039	3.020	3.091	.....	.005	.....	.....
9.	Clean up	.....	.....	.....	.....	4.042	.....	.....	.051	.....

Notes: Patch cost .0005246
Extra transportations, to sewing from C.S. to laundry from sewing to C.S. from laundry cost .00450 per each

Total time	.....	.067	.099 per 40
Grading 5%	.....	.003	.....
Total	.....	.070	.....
Misc. allow % 5	.....	.003	.....
Total	.....	.073	.....
Personal % 5	.....	.003	.....
Total allowed	.....	.076	.002
Total time	.....	.078	.....
Labor cost @ .019	.....	.01482	.....

Total of costs	.01482	labor for repair
	.00450	transport
	.0005246	patch
Total cost	.0198446	per each repair

laundry or to the wrapper supply, or of an unusually high rate of wrappers needing repair, it is probable that central service would not have a supply sufficient to meet the daily need. As has already been noted, the central service is always assured a plentiful supply of paper wrappers, since it can store three times as many paper wrappers as muslin wrappers on the same shelf space. When an order for new paper wrappers is placed, it requires the transportation of a case of the correct size from the storeroom to the central service—a matter of minutes.

Handling ease: It would not be feasible for the sewing room to make any more sizes of wrappers than the present small, medium, and large ones. Paper wrappers come in a far greater range of sizes, allowing the use of a wrapper of the correct size for every item to be wrapped.

Frequently the item is just a trifle too big for the small muslin wrapper, and much too small for the next size. This results in a greater difficulty in wrapping, loss of autoclaving space, and the same loss of storage space on the shelf because of the unnecessary bulkiness of the muslin wrapper. The item which can be wrapped in the paper sheet, size 8" x 8", requires four times as much space when wrapped in the smallest muslin wrapper.

Savings in autoclaving costs are obvious when one considers that 25 percent more items can be sterilized per load, if they are paper-wrapped rather than muslin-wrapped.

In the case of drying time per load, it is easy to demonstrate that both muslin and parchment require approximately five minutes longer drying time than any of the Kraft papers. In a central service in which autoclaving time is at a premium, the use of any of the Kraft papers could make possible the running of an extra autoclave load per day, due to this drying factor.

Ease of training: It is significant that the surgery personnel formerly in charge of doing most of the supplies have not mentioned a disadvantage of muslin which is extremely annoying to the lay person now being trained in the wrapping of supplies.

The lay person encounters very little difficulty in handling paper for wrapping, perhaps because she is familiar with using nothing but paper for wrapping such things as sandwiches, gifts, etc., in her own home. The same person will find using cloth for this purpose very difficult, since she cannot crease it as she folds it, and it therefore tends to flop and slide out of position. It requires more practice and more effort on her part to learn how to hold every fold of this material in place during the entire procedure of wrapping.

One other point concerning the "flopping" of muslin is that the same graduate nurse who now finds it "difficult to unwrap" paper-wrapped items has completely forgotten that she had to be very carefully trained to control the muslin wrapper while unwrapping a sterile package, when she was a student.

Purchasing advantages: It is far easier to write a requisition for desired sizes of paper wrappers than to figure out how many yards of material will be required to fill an order. It is also true that a discount may apply if the hospital purchases a sufficient number of paper wrappers in one order, but that the hospital of this size (91 beds) would pay full price for each muslin bolt, since it would not wish to order or be able to store the number of bolts needed to obtain a cut in price.

7. Bacteriological testing

Since we were not concerned at this time with testing for steam penetration, but rather with testing the possible filtering of dust and air through the outside wrapper under average storage conditions, the problem of how to conduct this test was decided by Dr. H. Mansell as follows:

Eleven packs of each type of wrapper were to be prepared, with three cotton-tipped applicators placed between the wrapper and the items wrapped, so that it would be impossible for these applicators to be protected by more than one layer of the wrapper.

All packs were sterilized in the lower front area of the autoclave. Two packs of each type were sent to the laboratory directly after autoclaving, to determine their sterility. All of these control packs were reported to be sterile.

At the end of one month, three packs of each type of wrapper were sent to the laboratory, and the cotton-tipped applicators from within each pack were used to culture the packs for fungus, aerobic, and anaerobic bacteria. The same procedure was followed at the end of the second and third months.

With one exception, these cultures were negative. The one exception occurred during the culturing of the packs of the second month, when a culture of *Staphylococcus albus* was obtained from one of the parchment packs. In the event that parchment should ever become the wrapper of choice in this hospital, which now seems most unlikely, further testing should certainly be done.

8. The cost per use of muslin—manufacture and handling included

Material used in the manufacture of wrappers comes in 72" bolts @ $.68 per yard. Since one yard equals 2,592 square inches, the cloth cost per square inch is $.00026. Wrappers are made in three sizes: small 15" x 15", cut 16" x 32" to offset hemming and shrinkage; medium, 30" x 30", cut 32" x 64" for hemming and shrinkage, and large, 45" x 45", cut 48" x 96".

The steps in the manufacture of a finished wrapper prior to its first delivery to central service for its initial use are as follows: tear, sew, stamp and launder. To the cost of the cloth and the cost of the labor to make the finished product are added a three percent-of-cloth-cost for purchasing and receiving, and a two percent-of-cloth-cost for storage.

Although cloth of this quality can successfully withstand over 120 launderings, its life expectancy as a wrapper, subjected to laundering, handling and autoclaving, is reduced to an average usage of 50 times, with 100 times given as an idealistic maximum. Study of the wrappers in use demonstrates that the average number of repairs to a wrapper during its life is at least four. These figures are in line with those quoted by other hospitals.

Manufacturing costs:

	15"x15"	30"x30"	45"x45"
Sq. in. per wrapper	512	2,048	4,608
Cloth cost per wrapper	.13430	.53719	1.20868
Tear and sew	.03810	.05700	.07752
Stamp	.00304	.00513	.00798
Launder (.054 @ lb.)	.00900	.02700	.05400
3% purchasing, receiving	.00403	.01712	.03626
2% storage, handling	.00269	.01074	.02417
Total costs	.19116	.65418	1.40861

Handling costs:	15"x15"	30"x30"	45"x45"
Repair (4 in 50 uses, prorated)	.00159	.00159	.00159
Launder	.00900	.02700	.05400
Sort and inspect	.00180	.00255	.00360
Wrapping costs	.00630	.00915	.00975
Total costs	.01867	.04029	.06879
Total manufacturing and handling cost per use with average 50 uses	.02251	.05335	.09697
Total manufacturing and handling cost per use with ideal 100 uses	.02060	.04682	.08288

In a review of the comparison of the papers tested, there is a definite trend toward the endorsement by all concerned, of the qualities of the 2-way creped Kraft for greatest ease and efficiency in handling. This is, therefore, the paper which has been compared, cost for cost, with the muslin wrap.

9. Comparison of costs

The "manufacturing" cost of this paper wrap will include the cost of each sheet and the three percent charge for purchasing and receiving, which was also charged against muslin, but will include only ⅓ of the two percent charge for storage and handling, since it has been established that three times as many paper wrappers can be stored in a given area, and that transportation and interdepartmental handling are almost eliminated for the paper wrap.

Handling costs of the paper include one repair (@ $.00150 throughout), and inspection and sorting, and wrapping costs, but of course do not include laundering. Costs per use for six uses, which is our average use, were determined by adding the handling costs to 1/6 of the "manufacturing" costs.

SUMMARY

We recommend the 2-way crepe Kraft to replace the bulk of our muslin wrappers for the following reasons:

1. Favorable cost is shown below (see chart for detail).

2. Satisfactory bacteriological test results and reports are available.

3. The 2-way crepe wrappers are more easily and efficiently handled than muslin.

4. Surgery personnel and the nursing unit personnel have found it acceptable and are accustomed to its use. Despite the fact that surgery personnel had previously used muslin entirely, they are now requesting delivery of paper wrappers instead of muslin, for the wrapping of many of

Comparison of Muslin and 2-Way Crepe Costs **

2-way crepe

Color	Size	Sheet cost	3% purchasing, receiving	1/3-2% storage	Cost to obtain	Handling	Cost per 1 use	Cost per each of 6 uses
Brown	7 x 7	.00355	.00011	.00002	.00368	.00795	.01163	.00856
Brown	8 x 8	.00445	.00013	.00003	.00461	.00795	.01256	.00872
White	8 x 8	.00405	.00012	.00003	.00420	.00795	.01215	.00865
Brown	10 x 10	.00603	.00018	.00004	.00625	.00795	.01420	.00899
White	10 x 10	.00540	.00016	.00004	.00560	.00795	.01355	.00888
White	10 x 12	.00554	.00017	.00004	.00575	.00795	.01370	.00891
White	13 x 13	.00687	.00021	.00005	.00713	.00795	.01508	.00914
Brown	13 x 13	.00950	.00029	.00006	.00985	.00795	.01780	.00961
Brown	15 x 15	.01345	.00040	.00009	.01394	.00795	.02189	.01027
Muslin	15 x 15				.19106	.01867		per each of 50 uses .02251
2-way crepe								
Brown	16 x 16	.01467	.00044	.00010	.01521	.00960	.02481	.01213
White	20 x 20	.01737	.00052	.00012	.01801	.00960	.02761	.01260
Brown	20 x 20	.01998	.00060	.00013	.02071	.00960	.03031	.01305
Brown	20 x 26	.02628	.00079	.00018	.02725	.00960	.03685	.01414
Brown	25 x 25	.03330	.00100	.00022	.03452	.00960	.04412	.01535
Brown	30 x 30	.04612	.00138	.00030	.04780	.00960	.05740	.01757
Muslin	30 x 30				.65318	.04029		per each of 50 uses .05335
2-way crepe								
Brown	30 x 40	.05985	.00180	.00040	.06205	.01485	.07690	.02519
Brown	40 x 40	.07875	.00236	.00053	.08164	.01485	.09649	.02846
Muslin	45 x 45				1.40861	.06879		per each of 50 uses .09697

**Prices quoted for 2-way crepe Kraft were obtained from the Hospital Net Price List S-57H, dated January 2, 1957, and printed with permission of the Dennison Manufacturing Co., manufacturers of "Sterilwrap."

the individual instruments and items which they do in the surgery department.

NOTE: During this testing period, a creped parchment appeared on the market. Simple wet rinsing of this product indicated that it contained a very high percentage of water-soluble softener, which later tests showed was of a glycerine nature. Further testing indicated that approximately 65 percent of the softener distilled out during the first autoclaving.

Since the sterilization of glycerine in a steam autoclave is an extremely hazardous process, the attempt was made to determine how much, if any, of this glycerine-type softener would distill out of the wrapper into the item contained by the wrapper, and the results lead to the belief that the major portion of the softener does enter the item. It is not possible to determine the exact percentage, since our entire testing area cannot be controlled at an absolute zero humidity. This wrapper was not accepted for further testing.

If the question of using this paper should arise, it would be advisable to determine the actual percentage and to determine whether the softener which enters the wrapped item combines with it in the same manner as oil coats a hair, rendering complete sterilization impossible.

Size of wrap	Muslin	2-way Crepe Kraft	
	cost per use @ 50 uses	cost per use @ 6 uses	cost per use @ 1 use
15" x 15"	.02251	.01027	.02189
30" x 30"	.05335	.01757	.05740
45" x 45"	.09697	.....	.....
40" x 40"	.....	.02846	.09049

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Sterilization by Heat*

By John J. Perkins, M.Sc.**

Principles for effective use of steam and dry heat

• Of the various sterilizing agents at our disposal, that of moist heat in the form of saturated steam under pressure is the most dependable medium known for the destruction of all forms of microbial life. Unlike many of the chemical bactericides in solution form, and other gaseous sterilizing agents, heat leaves no toxic residue on materials following the sterilizing process.

Steam is water vapor. As such, it presents a physical state of water as truly as ice does, but as a gas it may be near or far away from its condensing temperature. When we speak of saturated steam, we mean steam that contains the maximum amount of water vapor or exerts the maximum pressure for water vapor at a given temperature and pressure.

When steam is admitted to a sterilizing chamber, it promptly condenses upon contacting cold objects. As it condenses, it liberates a great amount of latent heat, simultaneously heating and wetting the materials and thereby providing the two requisites for the thermal destruction of microbial life—moisture and heat—which must always be present for effective sterilization.

The process by which bacteria are destroyed when subjected to heat is not clearly understood. The traditional theory is that death at elevated temperatures is closely linked to the alteration of proteins involving some irreversible protoplasmic change within the bacterial cell.

To be sure, it is known that moist heat is a more efficient sterilizing agent than dry heat. When moisture is present, bacteria are destroyed at considerably lower temperatures than when moisture is absent. This phenomenon has been explained on the basis that all chemical reactions, including the coagulation of proteins, are catalyzed by the presence of water.

Briefly, the generally accepted theory is that death by moist heat is caused by the denaturation and coagulation of some essential protein or enzyme-protein system within the bacterial cell, whereas death by dry heat is primarily an oxidation or slow "burning-up" process.

Today, in every modern hospital, there may be found a variety of sterilizers or autoclaves. All are dependent upon the application of certain fundamental principles allied with the use of steam as a sterilizing agent. Steam under pressure is used rather than atmospheric steam for the sole purpose of attaining higher temperatures. Pressure of itself has nothing whatsoever to do with the microbicidal properties of steam. Since atmospheric (nonpressure) steam has a minimum temperature of 212°F., it has no value for the sterilization of surgical supplies.

Boiling water is likewise an inadequate microbicide, and its use should be discouraged wherever steam under pressure is available. Several investigators have shown that heat-resistant bacterial spores will withstand boiling water at 212°F. for many hours of continuous exposure. There is also some question as to the efficiency of boiling water for the inactivation of certain viruses, such as those associated with serum jaundice or infectious hepatitis. It is considered more appropriate to designate the boiling-water process as one of disinfection or sanitization rather than sterilization.

The factors which have established pressure steam as the most reliable medium for the sterilization of surgical supplies are: its power of penetration, its microbicidal efficiency, and the ease of regulating or controlling steam for economical operation.

Saturated steam possesses the singular property of being able to heat materials and permeate porous substances by the rapid process of condensation, as opposed to the very slow process of heat absorption in the case of hot air or any other gas used as the heating medium. Also, saturated steam at a temperature of 250°F., equivalent to 15 pounds pressure, will destroy the most heat-resistant forms of microbial life within a brief interval of exposure.

Bacterial spores are recognized as the most resistant of all living organisms in their capacity to withstand external destructive agents. Anthrax spores, for example, dried on silk threads have

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been found viable after 60 years. Other viable spore-formers have been recovered from canned and hermetically sealed meat after a lapse of 115 years.

The magnitude of resistance to saturated steam is illustrated by the fact that certain spore cultures will withstand a temperature of 240°F. (115°C.) for more than three hours, whereas the vegetative forms of most bacteria are killed in a few minutes at temperatures ranging from 130° to 150°F.

Most authorities concur that no living thing can survive 10-15 minutes of direct exposure to saturated steam at 250°F. To my knowledge, none of the pathogenic organisms has been shown to be resistant to an exposure of even three minutes at 250°F.

To clearly define minimum standards of time and temperature for sterilization of the many kinds of hospital supplies is difficult. Unless this relationship can be stated positively, it is useless to attempt to discuss the subject intelligently or to make specific recommendations on the preparation and sterilization of the various items. Much of the information written on this subject is vague or inconclusive, or avoids the issue entirely.

Any exposure period that is selective in its lethality to microorganisms is not in keeping with the concept of absolute sterility —the goal of all surgical sterilization. It should be expedient always to prescribe a performance which carries a reasonable factor of safety in terms of time and temperature, based upon reliable experimental data relating to the destruction of the pathogenic spores, but also great enough to provide for the destruction of the still more resistant nonpathogenic spore-bearing organisms.

Carefully conducted studies strengthened by broad experience have shown that a minimum standard of time and temperature substantially greater or less than 12 minutes at 250°F. is either incompatible with modern sterilizer design (in which maximum operating pressure of the sterilizer is rated at 20 pounds per square inch), unnecessarily destructive of materials, or unsafe from the standpoint of effective sterilization.

This time and temperature standard of 12 minutes at 250°F. should not be interpreted as denoting a prescribed period of exposure for sterilization of the various articles. Rather, it indicates a minimum time-temperature relationship to be maintained throughout all portions of a load in order to accomplish effective sterilization. It does not take into account the additional time factor required for steam penetration of porous supplies or the rate of heat transfer through solution containers.

Since the order of death in a given bacterial population subjected to a sterilizing influence is governed by definite laws, it follows that if the temperature is increased the time may be decreased. Hence, the time-temperature relationship of 12 minutes at 250°F. has the following equivalents in terms of sterilizing efficiency:

2 minutes at 270°F.
8 minutes at 257°F.
18 minutes at 245°F.

In the interest of standardization, there is little justification for maintaining steam temperatures higher than 250°-254°F., equivalent to 15-17 pounds pressure, because sterilization occurs within a practical period of time at this range.

LIMITATIONS OF STEAM

Despite the outstanding advantages which characterize saturated steam as the ideal sterilizing agent, there are also certain limitations which decrease or may even nullify its effectiveness. Incomplete air elimination from the sterilizer is the most serious factor commonly encountered. Everyone concerned with the operation of sterilizers should understand that air-steam mixtures do not develop the temperatures characteristic of pure saturated steam under the same pressure. Hence, when air is present in the sterilizer, the killing power is diminished in direct proportion to the amount of air present.

It should also be recognized that steam is not suitable for the sterilization of such substances as anhydrous oils, greases, and powders. Because of their physical characteristics, such materials are not easily permeated with steam, and sterilization must, therefore, be accomplished by means of dry heat in the hot-air oven at a temperature of 320°F. for one hour or longer.

This subject of dry-heat sterilization is rather poorly understood in hospitals, although laboratories especially have employed the process for many years. In my opinion, the most efficient equipment for dry-heat sterilization is the mechanical convection hot-air oven, equipped with a blower for forced-air circulation. In addition, an efficient hot-air sterilizer should have performance characteristics as follows:

Power consumption — approximately 520 watts per cubic foot of chamber space.

Come-up time to 320°F. in chamber — no longer than 30 minutes.

Maximum deviation of temperature throughout chamber — ±2° F.

Many hospitals today are using the autoclave, with steam to the jacket only, as a substitute for the hot-air sterilizer. This procedure can be employed on a temporary basis, but it is not as reliable as the utilization of a properly designed hot-air sterilizer. Using the autoclave as a dry-heat sterilizer makes for a lengthy and inaccurate procedure, because the maximum temperature that can be attained in the chamber is 250°F. The exposure period required for sterilization at this temperature is a minimum of six hours, preferably overnight.

Furthermore, the thermometer regularly furnished on the autoclave does not function when steam is applied to the jacket only. Thus, there is no convenient means of indicating and recording the true temperature in the chamber.

Figure 1 shows the recommended time-temperature ratios for the sterilization of those supplies which can be sterilized best by means of dry heat.

—IMPORTANCE OF PACKAGING

Of the various factors which govern steam sterilization of surgical supplies, that of "packaging" is of prime importance. Operators should bear in mind that safe performance demands complete permeation of every strand and fiber of the material with the moisture and heat of the steam. The first requisite is, therefore, to restrict the size and density of the individual pack so that 30 minutes at 250° F. will insure uniform steam penetration with a liberal margin of safety in sterilization.

Figures 2 and 3 (page 38) demonstrate what *not* to do in the preparation of surgical packs.

The practice of using large dense bundles involves definite hazards. The largest packs should not exceed 12x12x20" in size for routine work. If packs with greater dimensions are required, the exposure periods must be prolonged to 40-60 minutes, with the likelihood of premature disintegration of the outer fabrics, as the result of overexposure.

Figure 4 (page 39) shows a pack arranged for muslin wrapping which is suggested as a model for all heavy packs. The alternate layers are crossed to promote free circulation of steam through the mass. Also, the lighter materials are located near the center of the pack. Packs prepared in this manner may be sterilized with an ample margin of safety in 30 minutes at 250° F. and dried out after sterilization in approximately 15 minutes.

——————PROTECTIVE WRAPPERS

Today, many hospitals are using various materials as substitutes for muslin in the wrapping of supplies. Some of these materials are satisfactory; others definitely are not. One should bear in mind that any protective cover or wrapper for surgical supplies must provide protection against contact contamination in handling and must also serve as an effective dust filter. Double-thickness muslin fulfills the requirement ideally. It possesses good filtering characteristics and does not inhibit or retard appreciably the passage of steam to the contents of the package during sterilization.

Canvas covers should never be used because the tightly woven fabric seriously retards the passage of steam and interferes with sterilization. Cellophane is also unsatisfactory because it is impervious to steam.

Articles such as catheters can be processed satisfactorily in cellophane tubing if the catheter is rinsed with water just before packaging, or if one end of the tubing is left open for release of air and admission of steam during the sterilizing process.

As a substitute for muslin, certain hospitals are using the vegetable parchment paper known as "Patapar" 27-2T Our tests on this product have indicated that it does permit passage of steam at a useful rate, and from bacteriological studies one may conclude that it is safe to use. However, it is advisable to allow a somewhat longer period following sterilization for drying of materials wrapped in Patapar, because the rate at which water vapor passes through it is much slower than that of muslin.

Some hospitals are using a 30 or 40-pound Kraft paper for wrapping gloves and other supplies. Commercial paper glove wrappers are also available, but their design or fabrication is not always as good as it should be.

My objection to the use of paper is that one never knows when it may develop holes or cracks not grossly visible, but still large enough to permit contamination

Figure 1

SUMMARY OF REQUIREMENTS FOR HOT AIR STERILIZATION OF SUPPLIES

Material	*Exposure Period From Time Sterilizer Shows Temperature of—*			*Quantity and Preparation*
	340°F. (170°C.)	*320°F. (160°C.)*	*285°F. (140°C.)*	
Glassware		60 minutes		Items must be clean and free from oil or grease.
Glycerine	60 minutes	120 minutes		Quantity should be limited to ¼" layer (approx. 1 oz.) in 200 ml. Erlenmeyer flask.
Instruments (Cutting Edge)		60 minutes		Instruments must be clean, free from oil or grease and placed on metal tray in sterilizer.
Needles (Hypodermic)		120 minutes		Needles may be placed in tubes having restricted sides, with cotton stoppers. Wire mesh baskets serve well as containers for tubes. Remove stylets.
Needles (Suture)		60 minutes		Sew needles into gauze pack, wrap in muslin.
Oils	60 minutes	120 minutes		Quantity should be limited to ¼" layer (approx. 1 oz.) in 200 ml. Erlenmeyer flask or similar container.
Petrolatum—Liquid	60 minutes	120 minutes		Same as for Oils.
Petroleum Jelly (Vaseline)	60 minutes	120 minutes		Quantity should be limited to ¼" layer (approx. 1 oz.) in Petri dish, ointment jar or other similar container.
Petroleum Jelly (Vaseline) Gauze		150 minutes		Quantity should be limited to 20 strips of 2" x 8" gauze and no more than 4-oz. Petroleum Jelly in catheter tray with dimensions of 2¼" x 8" x 1¼".
Powders	60 minutes	120 minutes		Quantity should be limited to ¼" layer (approx. 1 oz.) in Petri dish or other container.
Sulfonamide Powders			3 hours	Quantity should be limited to 4-5 gm. in double envelopes or cotton-plugged test tube.
Syringes (in Test Tubes)		75 minutes		Place assembled syringe with needle attached in test tube of suitable size. Cover top of tube with muslin.
Syringes (Wrapped)		60 minutes		Remove plunger from barrel and wrap in muslin. The needle embedded in gauze may be included in pack.
Zinc Peroxide			4 hours	For clinical application, quantity should be limited to 15-20 gm. in suitable container.

to gain access to the interior of the package. The repeated use of paper wrappers is certainly not good practice. In contrast, double-thickness muslin, with thread count of 140, retains its characteristics for a long period of time. It is probably the safest material that can be used for wrapping surgical supplies. Certain grades of twill are also satisfactory.

Anyone who anticipates substituting paper for muslin as a wrapping material should obtain information beforehand on the steam and air-transmission characteristics as well as the economic virtues of the product from the supplier. At present there is insufficient evidence to warrant the use of paper as a substitute for muslin, especially for the wrapping of supplies destined for the operating room.

——LOADING THE STERILIZER

The fundamental rule in loading the sterilizer is to prepare all packs and arrange the load in such a manner as to present the least possible resistance to the passage of steam through the load from the top of the chamber toward the bottom. Articles such as sheets, table covers, and towels must be arranged in the sterilizer so that they rest on edge rather than flat side up, in order to permit prompt and complete permeation of the materials with the moisture and heat of the steam.

Figure 5 shows an excellent example of how to arrange the load for a moderate-size sterilizer. The load has been laid out on a table top just as it is to be located in the sterilizer. All packs are resting on edge, in loose contact with each other. The upper layer is placed crosswise of the lower layer. This is recommended for routine practice in order to promote free circulation of steam throughout all portions of the load.

All jars, test tubes, and other nonporous containers for dry materials should be loaded in the sterilizer so as to provide a horizontal path for the escape of air. Figure 6 shows the correct and incorrect way to place jars of dressings in the sterilizer.

The same conditions apply to the use of multiple syringe holders or containers.

—PREPARATION OF CATHETERS

Catheters should be cleansed with an alkali detergent such as tri-sodium phosphate, Oakite, Pyrem, or Detergicide, and rinsed copiously with water immediately prior to sterilization. In this way the rubber is hydrated prior to sterilization, and then when saturated steam contacts it, superheating does not occur. A dry catheter will be deteriorated by contact with steam largely because of such superheating. Contact with the various quaternary ammonium compounds and synthetic detergents causes rubber to become tacky and markedly decreases its resistance to steam sterilization.

Catheters should be sterilized at 250° F. saturated steam for 15 minutes.

One should avoid all contact of catheters with mineral or vegetable oils, phenols, and cresols such as Lysol, because these substances cause tackiness and early disintegration.

————DURATION OF STERILITY

How long wrapped supplies may be considered to remain sterile in so-called clean, vermin-free storage is a question that is frequently asked by operating-room and central-service supervisors. The data reported on this subject in the literature is indeed scanty. By and large, protection against contamination of wrapped supplies is dependent upon the porosity of the protective cover or wrapper.

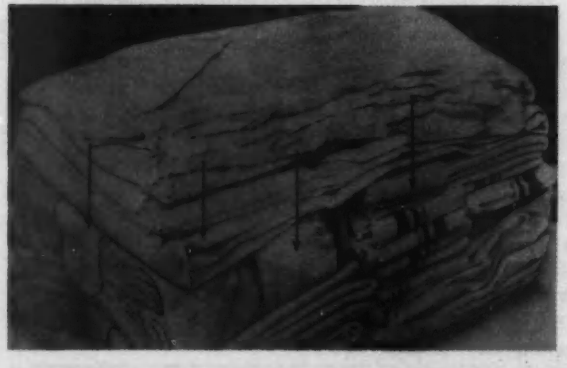
Sooner or later, depending upon the kind and extent of contaminating influence present in the storage area, changes in atmospheric conditions surrounding the packages and handling the packages, there is the possibility of microbial contamination gaining access to the interior of the packages. The most serious contamination hazard is that from insects and vermin (ants, roaches, and silverfish) which may gain access to the interior of a package through folds of the wrapper.

Some time ago tests were made to determine the effectiveness of double muslin covers in protecting sterile supplies from contamination in routine storage and handling. It was found that packs protected by muslin remained sterile on the supply shelves for three weeks.

More recent data indicates that

Figure 2 (below, left). The practice of using large and heavy packs should be discouraged.

Figure 3 (right). An example of faulty arrangement of the individual pack. The inclusion of basins with fabrics in one package should not be permitted. The basins seriously interfere with steam permeation and retard drying after sterilization.



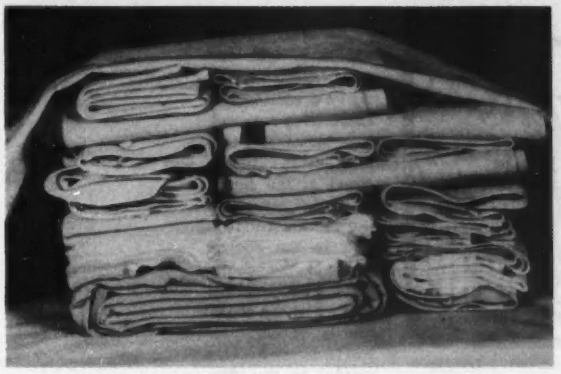


Figure 4 (above, left). This major pack arranged for muslin wrapping is suggested as a model for all heavy packs. Alternate layers are crossed to promote steam permeation. The table drape is folded once and spread out to form ultimately an inner covering of the pack. This provides a convenient method of draping the table as the pack is opened. After the pack has been covered with the table drape, an outer double-thickness muslin cover is put on and held in place with cord.

Figure 5 (right). A good example of proper arrangement of the load for a moderate-size sterilizer. All packs rest on their sides in close contact with each other. This arrangement promotes rapid steam permeation. The upper layer of packs should be placed crosswise of the lower layer as shown.

supplies packaged in either muslin or paper bags remain sterile for at least four weeks. For periods of storage longer than four weeks, it is doubtful that either muslin or paper can be depended upon—primarily because of the accumulation of dust particles on the wrapper which makes it difficult to open the package without transferring these dust particles to the contents.

Certainly there is no need to resterilize supplies at the end of one week or even two weeks' storage.

FACTORS IN FAILURES

Sterilization failures occur in many hospitals, even though personnel charged with the responsibility of sterilization have instructions for the correct preparation and sterilization of supplies. As a rule, surgeons recognize that all instruments and supplies used in the performance of an operation constitute a potentially major source of contamination for operative wounds. Therefore, each supervisor should be cognizant of the various factors which contribute to human error in sterilizer operation. Those of primary importance are:

(a) Failure to observe and understand the regulation of the sterilizer so as to maintain a saturated steam temperature of 250°-254° F., equivalent to 15-17 pounds pressure.

(b) Incorrect methods of packaging and wrapping of supplies, with little or no regard for the size and density of the individual packs.

(c) Carelessness in loading the sterilizer, with disregard for the necessity of providing for complete air removal and for free circulation of steam throughout the load.

(d) Failure to time correctly the proper period of exposure—usually due to ignorance or negligence on the part of the operator.

(e) Failure to carry out the correct sequence of operations in the sterilizing cycle, as the result of carelessness, fatigue, or distraction.

(f) Attempts to sterilize materials which are impervious to steam, such as talcum powder and petrolatum.

(g) Attempts to short-cut established methods of sterilization on the basis of limited bacteriological tests with organisms of unknown heat resistance.

STERILIZATION CONTROLS

The recording thermometer should be regarded as standard equipment on every sterilizer, not a luxury item. When properly installed and used, it is a practical detector of faulty sterilization. It indicates and records the same temperature as that shown by the indicating thermometer located in the discharge line of the sterilizer. It also records the duration of each exposure. Lacking the recorder, the operator can, and frequently does, forget to time the exposure when the temperature has advanced to 250° F. as prescribed.

Unless the sterilizer is equipped with a recording thermometer, it is difficult to maintain the required uniformity if several individuals have access to the sterilizer, or to prove what has or has not been done in routine practices. With use of a recording thermometer, if the exposure periods are

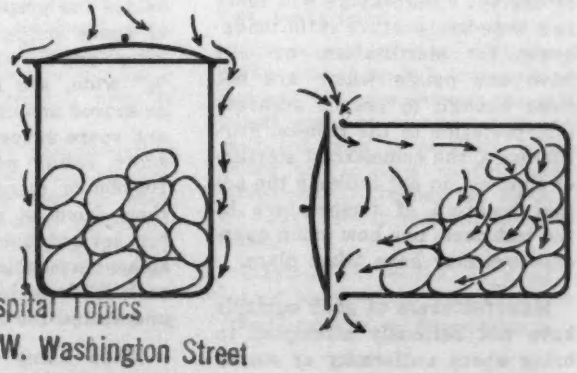


Figure 6. The incorrect and correct way to place metal jars or cans containing dressings in the sterilizer. If jar or can is rightside up, even with cover removed, air is trapped in container. When it rests on its side, with cover held loosely in place, air will drain out and steam will promptly take its place, as indicated by the arrows.

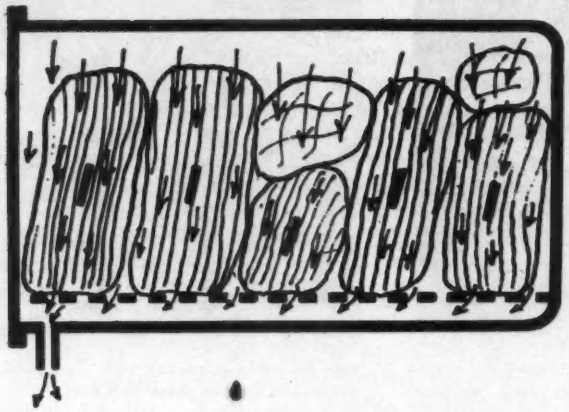


Figure 7. The correct method for using sterilization indicators or culture tests. The controls should be located in the center of the largest packs—near the bottom and in the coolest area of the chamber. The coolest portion of the chamber is at the front bottom, near the outlet to the discharge line.

greater or less than prescribed, or if the temperature has not been maintained within proper limitations, there is a positive record of the errors, which provides the evidence needed upon which to act in correcting discrepancies. The ability to prove with daily chart records that definite standards of time and temperature are being maintained should appeal to those who must shoulder the responsibility for sterilization.

Sterilization indicators have long been a controversial issue. Authoritative opinion is fairly uniform on the actual worth of all sterilization controls or indicators of the "telltale" variety. At best, their actual worth is questionable. They do tell you that a load has passed through a sterilizer.

It is my belief based upon observations and tests over the past 10 years that all sterilization indicators possess the same general disadvantage, to a greater or lesser degree; a percentage will react to a time-temperature ratio inadequate for sterilization, or will have end points which are not clear enough to permit accurate interpretation of the results. Furthermore, the commercial sterilizer controls do not indicate the actual build-up of temperature in the test pack, nor how much overexposure may have taken place.

Manufacturers of such controls have not seriously attempted to bring about uniformity or standardization of end points to conform to a safe time-temperature relationship required for sterilization of supplies. Consequently one type of indicator used in one hospital may react to a different time-temperature relationship than another type employed in another hospital.

If a sterilization indicator is used, it should be placed in the center of the largest and most densely wrapped package in the load (see Figure 7).

CULTURE TESTS

The use of culture tests to evaluate the effectiveness of a sterilizing process is the method of choice. Certainly they constitute a more direct approach to the lethality of the process and are more reassuring to bacteriologists and surgeons.

One of the most dependable culture methods for testing the efficiency of sterilization which is rapidly gaining in popularity involves the preparation of bacterial spore strips. Small strips of filter paper, about 2" long by ½" wide, are inoculated with a measured amount of a heat-resistant spore suspension, so that the spore count per strip averages 100,000 or more. The strips are then dried at room temperature for several hours and placed in steam-permeable paper envelopes, each 3" long by 1" wide, sealed, and stored for use.

When using the paper strips seeded with resistant bacterial spores as sterilization indicators, one should take care to insure proper placement of each strip in the test pack or load (see Figure 7). After completion of the sterilizing cycle, the envelopes are removed from the packs and returned to the laboratory for sterility testing of the strips.

Sterility tests should be conducted according to the procedure given in the *U. S. Pharmacopoeia*, XIV edition, page 758.

Organisms are known to vary greatly in their resistance to physical and chemical agents. Contrary to common belief, the spore-bearing organism known as *B. subtilis* or its variant *B. globigii*, is not especially heat-resistant. Recent studies have shown that most strains of *B. subtilis* will not withstand moist heat at 212° F. for much longer than 15 minutes. It is a good thing to keep in mind that culture tests are largely meaningless unless the heat resistance of the organism employed and the number of organisms present in the test sample are known. In addition, the culture should contain a high percentage of spores, and they should be dried before use.

The maximum benefits of progress in sterilization are not realized by the patient until hospital personnel are thoroughly trained to apply the principles and to operate the equipment intelligently.

Ethylene-Oxide Sterilization

By John C. Gabel*

● Ethylene-oxide sterilization has solved a long-standing problem in the hospital by providing an effective method of sterilizing materials which cannot withstand the heat or moisture of steam.

As we evolved our standards of sterile technic, it became more and more apparent that the all-important chain of asepsis had as many missing links as there were heat- and moisture-sensitive materials — such things as the various scopes, catheters, Foleys, delicate instruments, exteriors of ampuls of spinal anesthetics, intravenous tubing, and plastic accessories.

For years we have compromised with compounds such as organic mercurials, phenolic derivatives, chlorine, ammonium compounds, alcohols, and formaldehyde. Some of these could qualify only as disinfectants, and others were unsuitable because they had objectionable odors, or because they would chemically corrode the materials intended for sterilization. However, even the best of these compounds could not be considered sporicidal concerning the circumstances attendant to their use in the surgical suite.

The problem of effectively sterilizing articles containing wood, paper, leather, plastic, wool, or the delicate optical systems of the various scope instruments appeared, at first, to present insurmountable difficulties.

The perfect sterilizing medium for these special materials had to be one that would kill all bacterial life without the attendant damaging effects of high heat and/or moisture.

A study of the various forms of sterilization used in the pharmaceutical and food-processing industries pointed the way to gas as a possible solution.

For the last three decades, American industry has successfully employed a gas known as ethylene oxide as a means of reducing and destroying bacteria, yeast, and mold content, for the inactivation of unfavorable enzymes, and, more recently, for the sterilization of materials ranging in variety from pepper to penicillin.

The food-processing industry has been using ethylene oxide for over 25 years to control thermophilic bacteria. In many cases, the processing temperatures used in canning have little or no effect on these organisms. The nature of contamination of this type in canned products is especially severe when storage is at a temperature of 120°F. or above, as it is for Army rations under field conditions. It is to prevent such contamination that ethylene oxide is used to sterilize a wide variety of ingredients prior to canning.

Most of the large pharmaceutical houses have also been using ethylene oxide as a sterilizing agent for many years. The most common application has been for the processing of penicillin, streptomycin, and various other antibiotics. Use of ethylene oxide has also been reported in the processing of polyethylene commodities, powders, textiles, glass droppers and bulbs, rubber and plastic stoppers, and hypodermic needles.

In one large pharmaceutical plant which utilizes ethylene-oxide sterilization widely, some of the applications we found were for the sterilization of equipment and instruments constructed from metal and plastics, textiles used in the sterile area, antibiotic powders, needles, compounding equipment, and various additives employed in a wide variety of dosage forms.

The company reported that the life expectancy of expensive technical equipment was increased, sometimes a hundredfold, through the elimination of direct steam contact.

Use of this form of sterilization for textiles could be considered a luxury. However, garments worn by workers in the sterile area appeared new and fresh, as contrasted with the usual steam-scorched and stained garments.

Our studies and evaluation of the industrial applications of ethylene oxide led to the development of Steroxcide,®** which has ethylene oxide as its lethal component. As Figure 1 indicates, this gas will kill all known organisms at relatively low temperatures. All microbial life is destroyed—not merely inhibited in growth or rendered static.

Ethylene oxide has, in addition, the ideal characteristic of being noncorrosive. It will not discolor or chemically attack such supplies as metals, textiles, and plastics.

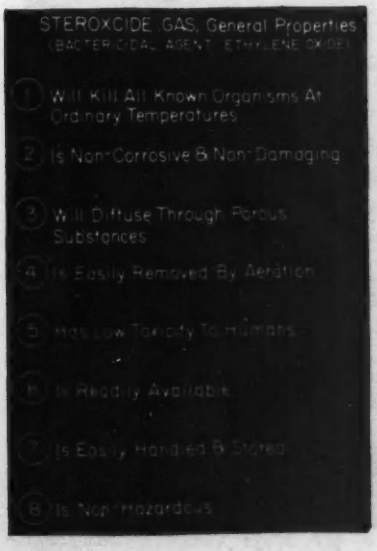
This gas will penetrate all types of porous substances. It is extremely active and will pass through the most minute openings encountered in such restricted areas as capillary tubing, hollow portions of needles, screw-thread sections, holding pet cocks, or the optical lens systems within instruments.

Ethylene oxide can be readily purged by aeration. Thus, after ex-

*Manager, Hospital Sterilizer and Light Sales, Wilmot Castle Co., Rochester, N. Y. This article is adapted from a lecture given at the fourth national congress, Association of Operating Room Nurses, Los Angeles, February 18-20, 1957.

**Manufactured by the Wilmot Castle Co.

Figure 1



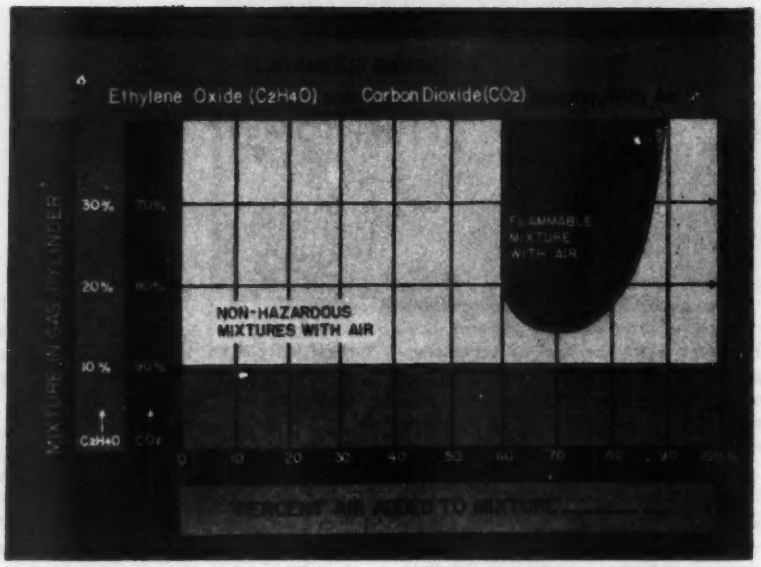


Figure 2

posure, an object brought into the normal atmosphere will completely lose all traces of the gas. No odor will remain, nor will surface deposits be trapped in hollow portions of instruments, as is the case with some other gases.

The gas has low toxicity to humans, despite its bactericidal power. It is quite safe for use even by unskilled personnel. Generally speaking, it has about the same toxicity level for humans as does the common household gas, ammonia. Small amounts may be inhaled without injury.

Overdoses will cause smarting of the eyes, and possible nausea, but no permanent effects. Treatment for over-dosage is as simple as finding a ready supply of fresh air.

Ethylene oxide is readily available, being manufactured in large quantities for use in the chemical industries. It is supplied to hospitals in small pre-loaded cylinders and also in cans.

CYLINDERS CAN BE STORED

In these forms, it is safely handled and stored. One cylinder or can is used for each sterilizing cycle. The refillable cylinders can be stored indefinitely without loss of potency.

One serious obstacle in making use of ethylene-oxide sterilization in hospitals was that this gas in its pure state is highly flammable. The factor of flammability appeared, at first, to rule out the use of gas in hospitals, despite its other ideal qualities.

Further research proved that the combustible nature of the gas could be eliminated by mixing it with an inert gas. It was found that either of two common inert gases was ideal for this purpose. A mixture of 90 percent by weight of carbon dioxide, or a mixture of 82 percent by weight of freon gas rendered ethylene oxide nonflammable.

This is shown in Figure 2 by the column at the bottom of the diagram, using carbon dioxide in this case as the inerting agent. With ethylene oxide and carbon dioxide in 10-90 percent proportion, there is no possible mixture with air which could be explosive. This means that if such a mixture were expelled into a room, no danger would exist.

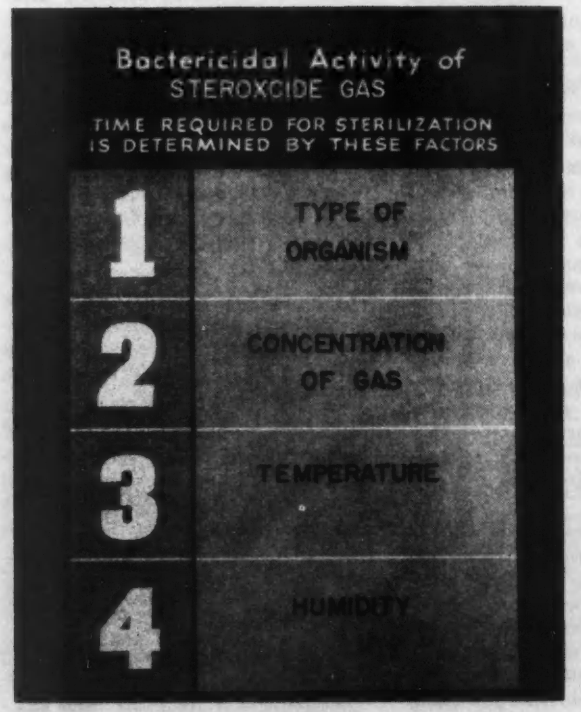


Figure 3

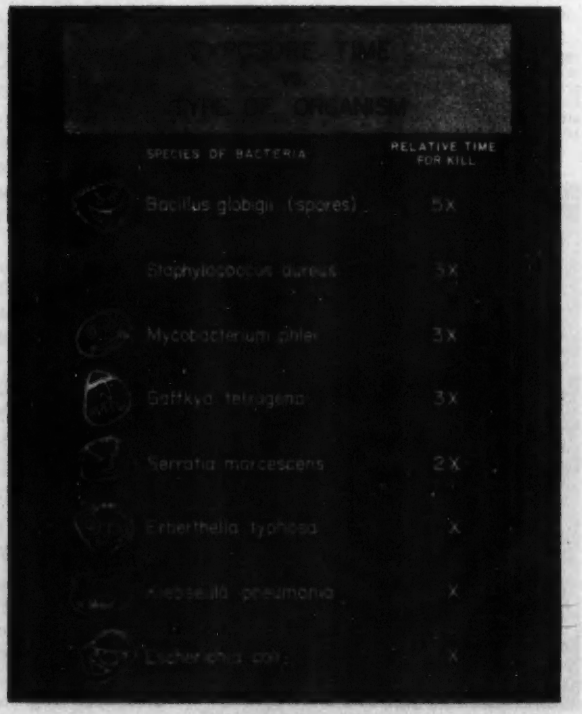


Figure 4

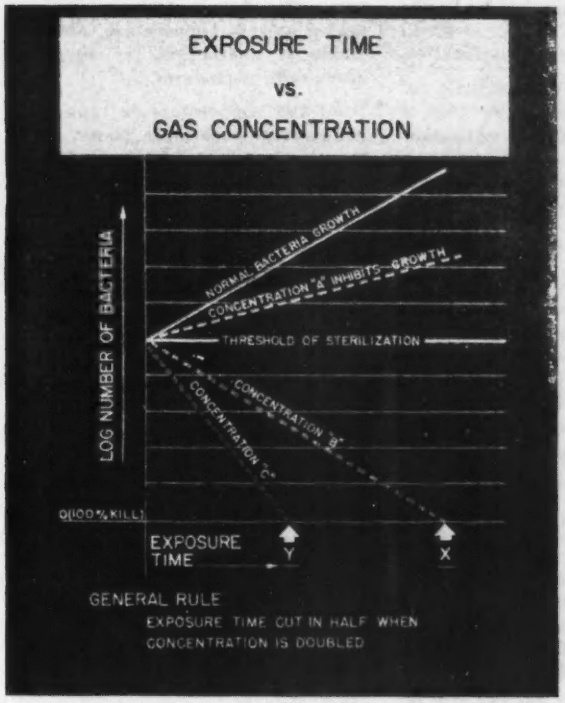


Figure 5

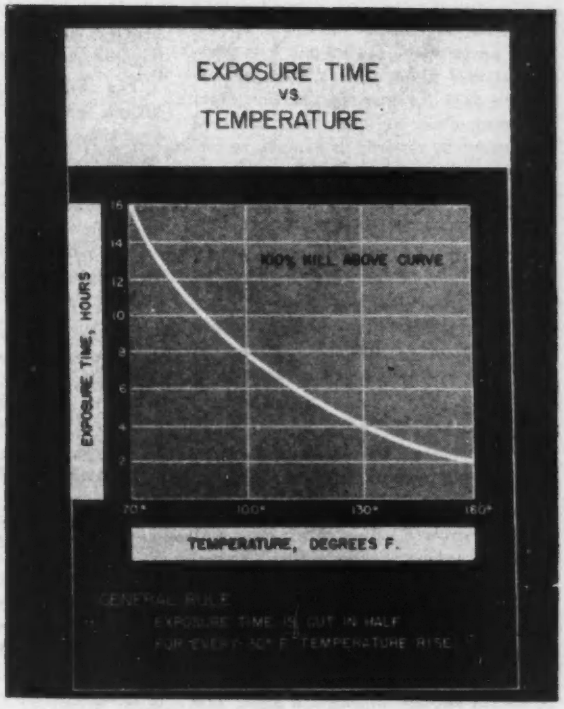


Figure 6

Even when a percentage of ethylene oxide is increased to 20 or 30 percent in weight, as shown, the mixture remains stable. In this case, when confined within the sterilizer chamber, even the concentrated mixture would be safe.

It is only when a 60 to 90 percent air mixture exists, as shown by the area marked "Flammable mixture with air," that a hazardous situation is theoretically possible. However, when the sterilizer is equipped for full automatic operation, even this becomes a mechanical and technical impossibility.

An ordinary gas range in the hospital, or in a home, presents far more risk in daily use than the operation of an automatic sterilizer employing ethylene oxide. This is emphasized because there may be an erroneous tendency to relate ethylene oxide to the use of anesthetic gases.

To provide a factor of safety, the Interstate Commerce Commission has recently prescribed a limit of 12 percent ethylene oxide and 88 percent freon for shipment as a nonflammable liquefied gas. For small sterilizers, this mixture can be hermetically sealed in light-weight shipping cans to provide sufficient gas for one sterilizing load. After the gas is expelled for the sterilizing cycle, the low-priced container can be discarded.

The disposable can is possible with the freon mixture, since freon gas develops only approximately 30 pounds pressure per square inch within the can, whereas the carbon dioxide mixture develops 850 pounds pressure, thereby requiring a much more expensive, high-strength pressure cylinder (See Figure 8).

In both cases, the concentration of ethylene oxide gas in the sterilizing chamber is the governing factor which results in ultimate bacteria destruction.

TREND TOWARD FREON USE

Since freon gas costs approximately eight times as much as carbon dioxide, it becomes a matter of practical economics as to whether the expensive gas mixture in a cheap, disposable container is preferable to a low-priced gas mixture furnished in expensive cylinders, on which there is usually a deposit charge plus shipping and billing costs for refilling. In general, the trend has been toward using the freon mixture in instrument sterilizers of sizes up to approximately 16"x16"x30".

Bulk sterilizers, large enough to process blankets, pillows, mattresses, and other large materials normally encountered in the central supply area, can be operated more economically on the carbon dioxide mixture. Mention is made of these specific materials because of the increased interest in ethylene-oxide sterilization as a result of the high incidence of staphylococcal infections.

The statement that ethylene oxide will kill all known bacteria at ordinary temperature is, of course, a broad one—because, as with steam or dry heat, there are certain variables that must be taken into account to insure that all bacteria are killed.

In establishing the exposure period, one must consider such variable factors as those shown in Figure 3: namely, the type of organism to be killed (and the type of materials to be processed), the concentration of gas used, the temperature to be attained, and the percentage of relative humidity within the sterilizer chamber.

The first variable concerns the *exposure period* necessary to kill various types of organisms. It is well known that some organisms are harder to kill than others. For instance, as Figure 4 illustrates, the least resistant nonspore-forming organism, *Esch. coli*, took only X hours to kill, while the highly resistant spore-forming *B. globigii* took five times X to destroy.

In general, ethylene oxide kills nonspore-forming bacteria with relative ease. Longer exposure is necessary

for non-pathogens or spore-forming bacteria. One cannot assume a knowledge as to what organisms are present at any given time. Thus all exposure data for gas sterilization must be predicated on the time interval necessary to destroy the most resistant organism, which we found to be *B. globigii.*

CONCENTRATION IS VARIABLE

There is no correlation between susceptibility of bacteria to heat and to gas. Some of the most heat-resistant organisms are killed rather quickly in gas; yet the converse is true with certain gas-resistant organisms.

A second variable is the *exposure time* as related to the *concentration of gas,* as shown in Figure 5.

Here the solid line labeled "Normal bacteria growth" illustrates the point that the longer bacteria are allowed to remain in the natural state, the more bacteria are developed. A relatively weak concentration of ethylene oxide, as shown at "A," will slow up or inhibit this growth, but it is not powerful enough to effect a kill. The performance level has remained above the "threshold of sterilization."

Concentration "B," theoretically, would wipe out the bacteria colony in X number of hours, and the even more powerful "C" concentration would destroy the same colony in the shorter time of "Y." Both are well beyond the threshold of sterilization.

The higher the concentration of killing gas, the shorter the time of exposure needed for sterilization. Actually, this is approximately a straight-line function—that is, with the concentration doubled, the exposure time is halved. One need have no concern for this, however, since it is provided for in the sterilizer's control system.

Ethylene oxide and carbon dioxide, in their respective liquid states, have different weights and so have a tendency to stratify in the cylinder. In view of this fact, these materials are furnished in the form of a single-shot cartridge which permits the entire contents to be discharged into the sterilizer chamber, where it then reverts to a gaseous state.

Since the molecular weights of carbon dioxide and ethylene oxide in the gaseous form are identical, the suspension will remain constant throughout the sterilizer chamber, and one is assured that every surface will be exposed to a lethal mixture.

A third variable is *exposure time* as related to *temperature level.* Figure 6 shows that one can sterilize with gas at temperatures as low as 70° F., or comfortable room temperature. The 14- to 16-hour exposure period at this temperature, however, makes it impractical for operating room suite procedures.

As the temperature is raised, the gas goes to work much faster. With the temperature at 130° F., for instance, the time element has been reduced to four hours.

As a rule-of-thumb, for every 30° F. temperature rise, exposure time is halved, all other conditions remaining constant. It should be noted that although the speed of killing the organisms is greatly accelerated, the temperature level remains relatively low, considerably below the damaging extremes of steam or dry-heat sterilizing processes.

EXPOSURE CAN BE REDUCED

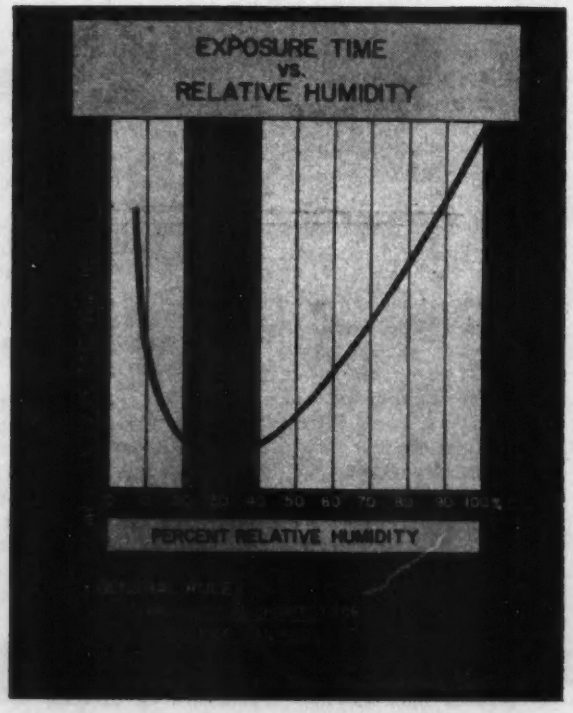
If at first the length of this exposure seems extreme, one should remember that we are replacing compromise technics in which exposure time is far greater. We refer specifically to the alternates of soaking in germicidal disinfectants or exposure in cabinets using dry formaldehyde gas.

Cystoscopes, bronchoscopes, plastics, rubber, paper, cotton, wool, and even powder can withstand at least the 130° F. temperature, thus making it possible to reduce the exposure period to only three or four hours.

The fourth and final variable is *exposure time* vs. *relative humidity.* The percentage of relative humidity within the sterilizer chamber drastically affects the lethal quality of ethylene oxide. Under conditions of very low humidity, or dryness, the resistance of spore-forming organisms to the gas is greatly increased. Tests substantiate that when the relative humidity is controlled within a range of approximately 20 to 40 percent, as shown in Figure 7, the same spores are rapidly destroyed.

Conversely, an overabundance of moisture, above the 40 percent level, has the opposite effect. The spores again become hard to kill. Thus it becomes a problem of controlling the relative humidity of the chamber within the desired 20 to 40 percent range. In the Sterox-O-Matic® system,* a special water-injection assembly, or humidifier, performs this function automatically.

Figure 7



PROCESS MADE AUTOMATIC

Study of industry's experiences with ethylene oxide brought to light

*Manufactured by the Wilmot Castle Co.

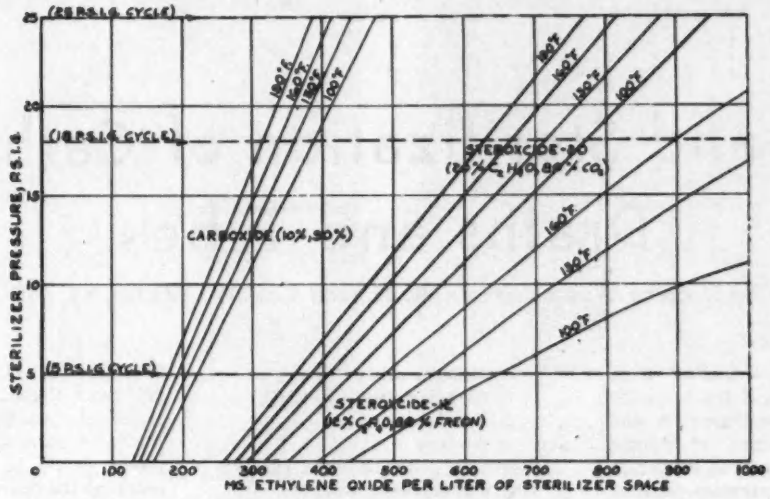


Figure 8. This shows pressures encountered in a sterilizer when air is evacuated at various chamber temperatures. With the horizontal scale representing concentration of the killing gas, ethylene oxide, it is seen that with any gas concentration the resulting chamber pressure is considerably lower when the freon mixture is employed.

This chart also illustrates that with a given size of pre-filled cylinder (containing either the carbon dioxide or the freon mixture), the concentration in the sterilizer will remain constant in terms of milligrams of ethylene oxide per liter of sterilizer space. However, the chamber pressure reached will be different according to the temperature of the chamber during the sterilizer cycle.

Chamber pressure, therefore, is not the important factor; concentration of the gas is of foremost importance.

the value of temperature, moisture, and concentration control. By reducing these factors to an automatic process, it is now possible to assure the maintenance of optimum conditions within the sterilizer chamber at all times.

With ethylene oxide it will be possible to process such items as cystoscopes, bronchoscopes, surgical needles, scalpel blades, catheters, Foleys, the exterior of spinal anesthetic ampuls, all sharp instruments, especially the ophthalmic instruments —in fact, any and all items now being processed in germicidal solutions.

CAN PENETRATE PLASTIC

Another singular advantage of ethylene oxide is its unusual ability to penetrate a plastic film. This makes it possible to develop technics whereby one can take the aforementioned supplies, package them in a polyethylene bag, and heat-seal the bag prior to sterilization. The ability to sterilize the contents of the bag through the plastic film has the obvious advantage of preserving sterility indefinitely.

Such packaging technics would also have advantages for certain sets of instruments which must be available in a sterile state, but are used rather infrequently and spend most of their life being recirculated without operative use.

Having a bulk sterilizer available for this type of sterilization enables the surgical supervisor to consider the routine sterilization of such items as porous operating-room table accessories and anesthesia equipment, in an effort to reduce the number of cutaneous and surgical wound infections. She may also consider the advantage of sterilizing a heart-lung oxygenator as an assembled unit.

Care and Sterilization of Catheters, Drains and Tubes

By Dorothy Wysocki Errera, R. N., and Carl W. Walter, M. D.*

The resin latex, extracted from many tropical plants, is the basis for some of the most fundamental and vital tools in patient care. While inert plastics have supplemented rubber in the fabrication of catheters, drains, and tubing, the singular problems of care and sterilization of rubber cannot be ignored.

The manufacture of synthetic rubber (neoprene, synthetic latex) in the United States is a recently developed industry. In the production of both natural and synthetic rubber products, 1,000 to 1,500 different chemical compounds are used which are potential allergens both to the industrial worker and the ultimate user.[1] Considering the enormous number and frequency of contacts with rubber products, the sensitizing potential is low, but since it has been well documented,[2] the nurse and physician should be alert to signs in both themselves and patients.

As with all surgical instruments, if performance of a rubber catheter, drain, or tube is not perfect, patients are subjected to needless discomfort and trauma and, in extreme cases, mortality.

Acid-cured latex occupies a position of prominence in the fabrication of surgical devices, but no distinction is made in this discussion between it and other types of rubber common to hospital products. The same fundamentals, intelligently applied, will prolong the useful life of all.

Many compounds which hasten deterioration of rubber are stocked in the hospital and operating room and are essential to patient care. The following list[3] represents the most common and should serve as a guide for extra care or precaution. Rubber soiled with any of these should be cleansed as soon as possible.

1. Petroleum by-products and hydrocarbon solvents
   a. Vaseline—petrolatum jelly
   b. Mineral oil
   c. Cleaning fluid—Renuzit
   d. Benzene
   e. Acetone
2. Vegetable oils: Cajuput, eucalyptus, wintergreen, pine, etc.
3. Glycerin
4. Ether
5. Esters which are most commonly found in medications but are also in white wax, yellow wax (beeswax), benzyl benzoate USP, methyl and ethyl salicylate common in liniments
6. Oxidizing acids: Sulfuric, hydrochloric, etc.
7. Copper and manganese, indigenous to most sterilizer fabrication
8. Phenols and cresols
9. Ozone which is generated by fluorescent light, electric motors and diathermy machines
10. Excessive heat and sunlight

In manufacture, rubber products are dusted liberally with talcum or other dusting powder to prevent adhesions of the rubber surfaces. Often, this powder itself is an allergen,[4] and new gloves, catheters, etc., should be washed well before use to avoid confusion of sporadic sensitivity to latex with sensitivity to the original industrial dusting powder.

CARE

Aging contributes as heavily to rubber deterioration as use, and inventory should be controlled to avoid prolonged shelf storage. Supplies should be dated when stocked and put into circulation within 12 months of purchase.

Rubber goods are best washed in a mild alkali detergent such as trisodium phosphate or household Oakite,* then rinsed in tap water, and dried and dusted with an absorbable, non-irritating powder. A mixture of amylose and amylose pectinate and magnesium oxide** protects rubber, withstands sterilization, is innocuous to skin, and causes minimal tissue reaction. Recent work has shown occasional reaction to amylose pectinate.[5, 6] Hence, all sterile rubber goods should be rinsed well before reaching the operative field or patient.

PACKAGING

Packaging of sterile supplies, including catheters, in cannisters is discouraged because vagaries of human behavior are uncontrollable, and the remainder of a stock supply cannot be considered sterile after the initial selection. Simple technics of packaging make individually sterilized supplies practical for every patient.

Individual catheters may be packaged in wrappers of double-thickness muslin permeable paper,*** or cellophane tubing.**** [7] In either technic, the lumen of the catheter is flushed with distilled water immediately before sterilization. The technic for wrapping with muslin or paper is standard.

When cellophane tubing is used, the moistened catheter is threaded through a paper guide and inserted into a length of tubing. The end through which the catheter will ultimately be withdrawn is folded and shut with a paper clip (Figure 1). The opposite end is left open during sterilization to allow for an exchange of air and steam and is sealed with pressure-sensitive tape* when the catheter is removed from the autoclave.

Catheters packaged in either manner can be stored indefinitely after sterilization in a clean, dry, vermin-free place. Added caution is indicated in the use of cellophane tubing to avoid puncturing or splitting of the tubing. The latter technic has the advantage of quick identification of catheter size.

The equipment essential for cathe-

*Associate clinical professor of surgery, Harvard Medical School, Boston, and surgeon, Peter Bent Brigham Hospital, Boston

* Oakite, Oakite Products, Inc., New York City
** Bio-Sorb, Ethicon, Inc., New Brunswick, N. J.

*** Sterilwraps, Meinecke and Co., New York City
**** Edward Weck and Co., Brooklyn, N. Y.

*Scotch Brand #222, Minnesota Mining and Mfg. Co., St. Paul, Minn.

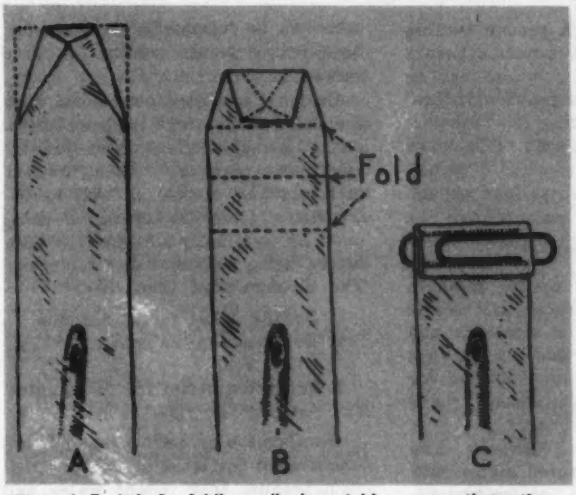


Figure I. Technic for folding cellophane tubing over catheter tip.

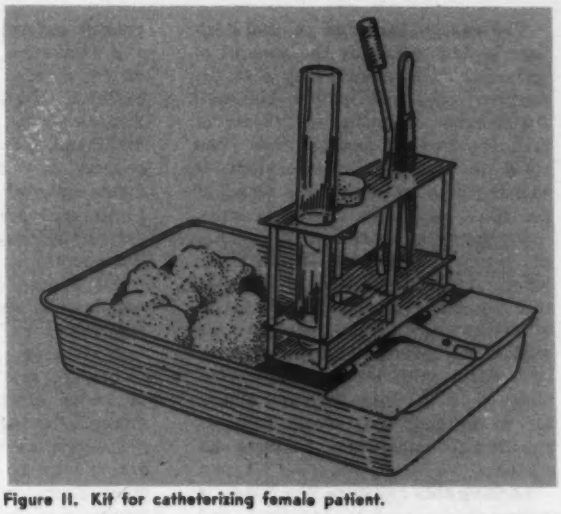


Figure II. Kit for catheterizing female patient.

terization of the female patient is conveniently assembled in a kit, the container** for which serves itself as a receptacle for germicide, and contains pledgets of cotton and forceps for disinfecting the meatus; two glass, metal, or plastic female catheters, and test tubes and corks for containing the urine sample (Figure 2).

A sterile kit is commercially available*** which includes a polyethylene female catheter affixed to an 85 cc. volume polyethylene bag. After catheterization is accomplished and the urine sample collected, the catheter is slipped from the bag, and the residual urine is drained in a routine fashion. The neck of the bag allows a double fold to be made which can be sealed with a clip. A tag, which is fixed to the bag during manufacture, permits prompt and sure identification of the sample (Figure 3).

**Macalaster Bicknell Co., Cambridge, Mass.

***Dade Reagents, Inc., Miami, Fla.

Figure III. Cath-Urine.

STERILIZATION

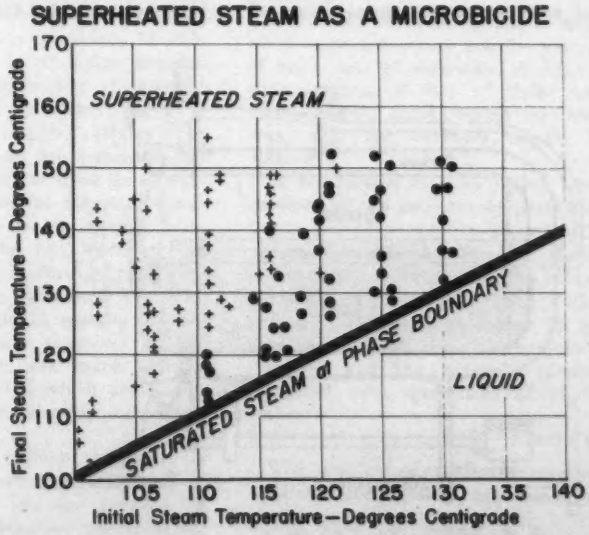
Sterilization in saturated steam affords the greatest safety for the patient, and when properly done is not excessively destructive of rubber. Certain precautions must be observed when sterilizing rubber in steam:

- Avoid superheating
- Avoid mixtures of air and steam
- Avoid excessive heating.

When additional heat is applied to a volume of saturated steam in which there is no liquid water present, the temperature increases above that of steam at the phase boundary and superheating occurs.[8] This is undesirable, because aside from being a poor microbicide, (Figure 4), superheated steam causes early destruction of textiles and rubber.

Several factors contribute to superheating in the steam sterilizer,[9] but one simple practice will obviate much of the trouble from this source. If textiles and rubber goods are hydrated with a small quantity of distilled water immediately before sterilization, enough moisture is provided to prevent the superheating which occurs when a dehydrated package is exposed to steam and heated from room temperature to sterilizing temperature.

Figure IV. Superheated steam as a microbicide.



Savage (25)

The energy liberated in the sterilizer is determined by the amount of water which is adsorbed by a textile fiber or other hydrophyllic material. An amount of energy in excess of that required to heat a fiber from room to sterilizing temperature is exchanged in satisfying the thirst of the fiber, and superheating results.

Flushing the lumen of a catheter or the inside of an Asepto bulb before sterilization provides the moisture necessary to insure sterilization of the entire inner surfaces. As the wall of the catheter or bulb is heated by contact with steam, the film of moisture in the lumen turns to steam, air is purged, and moist heat at sterilizing temperature contacts all surfaces.

Lacking this moisture, the lumen is essentially exposed to dry heat, and the necessary exposure time for destruction of organisms in dry heat is not provided in the cycle of steam sterilization.

During steam sterilization, air, being denser than steam, gravitates to the bottom of the sterilizer and eventually clears through the air and condensate discharge line (Figure 5). Loading rubber goods in the upper two-thirds of a sterilizer makes for quicker and more uniform heating and avoids contact with oxygen in the residual air.

To avoid the prolonged exposure essential for penetration of large packs of textiles, rubber goods are ideally sterilized alone or with instruments, plastics, glassware, or small packages. When properly packaged and positioned, the sterilizing cycle can be that time necessary to destroy resistant spores, 13 minutes at 121° C. (250° F.)[10] (Figure 6).

Standardization of sterilizing practice, however, has many advantages and provides an additional factor of patient safety. With proper loading and packaging, a 30-minute exposure as for textiles and solutions can be enforced without excessive deterioration. In actual practice, few catheters withstand the onslaught of bandage scissors or "do-it-yourself" adjustments by staff members long enough to warrant serious concern over the destructive effect of repeated sterilization.

All rubber loses tensile strength temporarily when heated, and this is manifested by loss of elasticity and easy ripping. If rubber goods are allowed to dry and stand unused for 48 hours after sterilization, tensile strength is regained.

Preoperatively, catheters and drains may be sterilized along with other instruments in the instrument-washer-sterilizer or steam sterilizer. Here, they should be protected from the weight and excessive heat of metal instruments. Judicious selection of catheters for a procedure, facilities for emergency sterilization, or an inventory of assorted catheters and drains in sterile packages can eliminate unnecessary sterilization and resterilization of multitudes of catheters and drains.

The urinary tract, normally sterile except for approximately one centimeter proximal to the anterior urethra, becomes infected by a variety of pathogens. Bacillary infections are most common; *Staphylococcus aureus* is the most common of the cocci, and *Staphylococcus albus* and *Staphylococcus fecalis* are occasional offenders. In chronic infections, proteus vulgaris is the causative organism. The tubercle bacillus is the most important and most common invader in specific infections.[11] The high potential of risk of transmission of infection makes it mandatory that soiled catheters be terminally sterilized by heat before being handled for processing.

Evidence has been established that the blood-borne virus of homologous serum jaundice is not destroyed by any known chemical.[12] Hence, unused catheters and drains, as well as instruments from the operative field, must be terminally sterilized in heat before being returned to circulation. The recommended times are:

1. Boiling water for 10 minutes
2. Dry heat for one hour at 180° C. (356° F.).
3. Saturated steam for 15 minutes at 121° C. (250° F.).

Sanitization by boiling water is not encouraged for latex or rubber products because they imbibe water and lose tensile strength, elasticity, and shape. If other facilities for sterilization are lacking, boiling for 30 minutes will destroy the vegetative organisms present. Rubber goods must be kept submerged, and their inner surfaces must contact the boiling water.

Copper and zinc, both exceedingly destructive of rubber, are commonly used in the fabrication of sterilizers, and any break in the plating of the inside surface of the sterilizer necessarily exposes rubber articles to their destructive action.

CHEMICAL DISINFECTION

With facilities for heat sterilization ubiquitous in the modern hospital, clinic, or doctor's office, there is little reason to rely on the erratic, limited worth of chemical disinfection. The increasing incidence of homologous serum jaundice further makes it essential that any instrument in contact with blood or tissue fluid be terminally sterilized in heat before being handled. Chemical disinfection should be restricted to use on new or

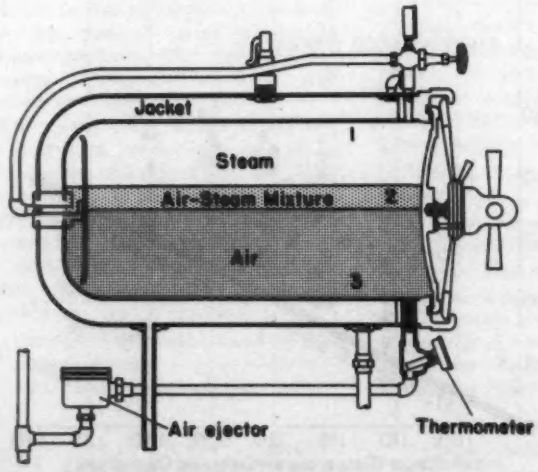


Figure V. Stratified air in steam sterilizer.

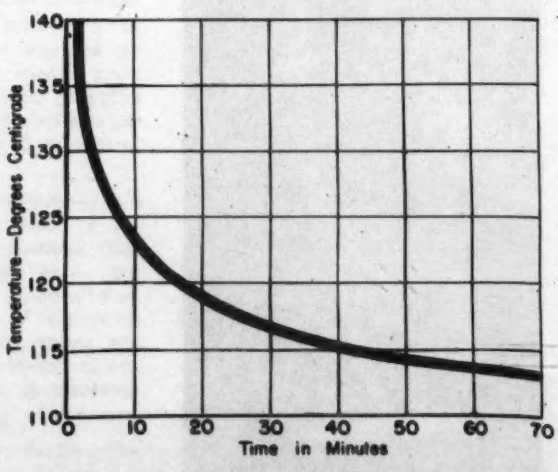


Figure VI. Thermal death time of resistant spores.

non heat-stable items.

There are few chemical compounds which are not destructive of rubber, and if chemical disinfection is unavoidable, the choice of an agent is critical. The quaternary ammonium compounds are the least noxious and are non-toxic. Numerous brands are available,[13] and only a partial list appears here:

Ceepryn Chloride — William S. Merrell Co.

Cetylcide — Curvlite Corp.

C.R.I. Germicide — Clay-Adams Co., Inc.

Detergicide — C. R. Bard, Inc.

Diaparene — Homemaker Products Corp.

Phemerol Chloride — Parke-Davis and Co.

Resectocide — American Cystoscope Makers, Inc.

Roccal — Winthrop Laboratories, Inc.

Urolicide — American Cystoscope Makers, Inc.

Zephiran Chloride — Winthrop Laboratories, Inc.

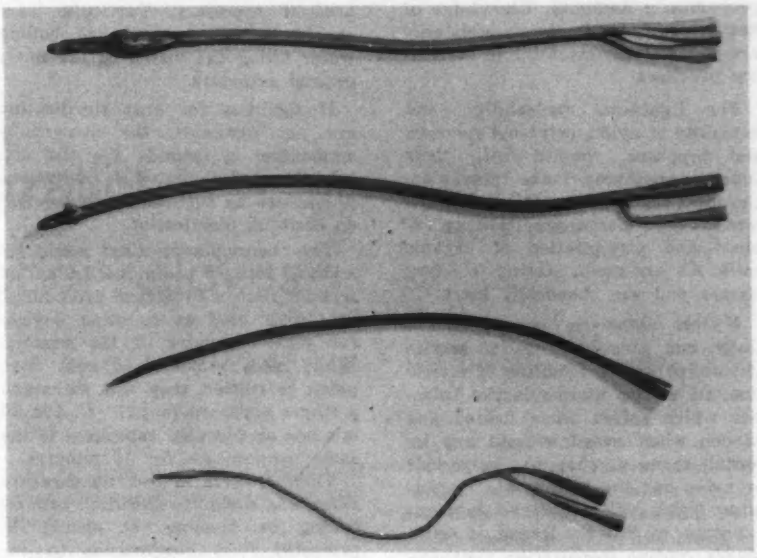
With all, an aqueous solution is used, and the articles put to soak must be clean, dry and oil-and-grease-free. All surfaces (inner and outer) must be exposed to the germicide by complete immersion. The minimum time is 30 minutes for destruction of vegetative organisms. Dilutions vary with the individual manufacturer.

Use-dilution of germicides, in addition to the bactericidal or bacteriostatic effect, is of significance because adsorption of the germicidal ingredient is very high in low concentrations. Porous materials will adsorb 70 to 90 percent of the active agent from a solution containing 10 to 30 ppm (dilution of 1:15,000). As the concentration increases, adsorption decreases markedly.[14]

Germicides should be used at the maximum feasible dilution, and free fluid should be present in the disinfecting container at all times. Higher concentrations of germicide are necessary to disinfect porous materials, and dilutions recommended for instruments should be reduced when rubber goods, sponges, etc. are to be immersed.[15]

Rubber goods must be rinsed promptly and copiously after exposure to quaternary ammonium compounds to remove all residual traces and avert subsequent tackiness. Synthetic rubber should never be exposed to the quaternary ammonium compounds. Raising the temperature of these compounds increases their efficiency, and boiling for five minutes in an aqueous solution will destroy vegetative organisms.

Fig. VII. Catheter destruction due to improper sterilization.



Formaldehyde cabinets, the historical "sans pareil" of urological practice, are poor disinfectors. Dry formaldehyde gas has no germicidal properties, penetrates poorly, and requires prolonged exposure.[16]

There is no commercially available, small sterilizer that successfully combines the essential humidity and lethal formaldehyde concentration necessary for destruction of organisms. In sterilizers in which these features are controlled,[17] formaldehyde gas is contra-indicated for disinfecting catheters which are intended for obtaining urine for culture. The formaldehyde gas condenses as a film of paraform on the inner surface of the catheter and is dissolved by the urine. The formalin solution which results is bacteriostatic, and examination of the urine for bacteriological purposes is worthless. In this respect, reports of all urine samples collected with chemically disinfected catheters should be suspect.

The balloon catheter (Foley), in addition to its use for hemostasis in the prostatic bed, is used as a self-retaining catheter for constant drainage. The latter use in aged or disoriented patients has reduced the nursing care heretofore necessary to keep the patient clean and dry. The patient's attempts to remove the offending device are thwarted by the distended balloon, and much trauma and time are saved which previously were spent in re-inserting indwelling catheters.

The inflated balloon, however, is potentially inconvenient in that it may rupture in the bladder if weakened by improper sterilization. Or it may fail to deflate, with obvious complications.

The precautions outlined for sterilization are particularly applicable to the Foley catheter, and the inside of the balloon must be hydrated as well as the lumen of the catheter. This is easily accomplished by flushing the inflation tunnel and balloon with a small quantity of distilled water.

When using catheters with the new self-sealing plugs, water should be injected and aspirated through a one-inch, 20 gauge needle. The thin film of moisture is adequate for sterilization of the inflation tunnel and balloon. Laboratory tests* showed complete deterioration of the balloon of a Foley catheter sterilized at 250° F. for 30 minutes without preliminary hydration.

The Foley catheter should be minutely inspected before use for change of color, loss of elasticity, cracks, or easy tearing. If any of these conditions exist, deterioration is under way, and the catheter should be discarded.

If the balloon fails to deflate when removal of the catheter is attempted, the following procedure is used. The patient's bladder is filled with water, and one or two cc. of ether or chloroform are injected into the inflation tunnel. The bag is weakened by the solvent and ruptures. The catheter is removed and the patient's bladder irrigated with quantities of sterile water.[18]

PLASTICS[19]

The wide range of plastic materials available for medical use makes an

* C. R. Bard, Inc., Summit, N. J.

awareness of their basic physical properties a necessity. Knowledge of heat stability and solvent resistance are particularly essential to sterilizing practices.

The lightness, malleability, and flexibility of nylon, polyvinyl chloride, and neoprene, coupled with their superb smoothness, make these plastics ideal for the fabrication of catheters. They discourage clotting of blood and precipitation of organic salts. All are non-irritating to living tissues and are chemically inert.

Nylon catheters, expensive initially, can give long, useful service if handled with a modicum of discretion. Of all the thermoplastics (plastics which soften when heated and harden when cooled without any internal chemical change), polyamide or nylon has the highest heat resistance. Nylon will withstand constant exposure to 300°F. Hence, it withstands routine sterilization practices. Nylon, however, will absorb moisture to a limited degree (1.5 percent in 24 hours), and prolonged soaking should be avoided. Drying in a warming cabinet at regular intervals of use will prevent blistering and cracking, which are the result of accumulated absorption of moisture.

The nylons have excellent chemical resistance. Some are soluble in alcohol, others in phenols. Therefore exposure to both of these compounds should be avoided. Mineral acids are destructive, but organic solvents have no effect and strong alkalies have a negligible effect.

Nylon catheters should be packaged for sterilization without coiling or bending and should be protected from the weight of other instruments or packages in the sterilizer.

Boiling water sanitization can be used if necessary. Particular care should be taken to insure boiling water filling the lumen of the finely gauged catheters.

If facilities for heat sterilization are not available, the quaternary ammonium compounds are the disinfectants of choice. The limitations of use are as outlined in the section on chemical disinfection.

The thermoplastic vinyl resins, in addition to their usefulness for catheters for routine urological procedures, are being used as splinting devices for plastic repairs of the ureters. While more sensitive to heat than nylon or rubber, they will withstand a single exposure to 121° C. for 30 minutes or repeated exposures to the same temperature for 15 minutes.

Vinyl distorts in this temperature range and should be sterilized without coiling or bending. It should be protected from compression by instruments or other articles in the sterilizer. In the boiling water sterilizer, vinyl needs protection from the imprint of the sterilizing tray.

Vinyl catheters do not absorb water and do not need routine drying as nylon or rubber. They are resistant to attack by soaps, oils, alkalies and alcohols.

The care of these plastic items is compatible with routines outlined for either rubber or nylon. The sterilizing cycle is qualified to prolong the usefulness of the catheter if repeated use is anticipated.

Chemical disinfection is accomplished with the quaternary ammonium compounds, as outlined in the section on chemical disinfection.

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ILLUSTRATIONS

Figure 1. Kiefer and Mitch, "A Method of Sterilizing Catheters and Storing them for use," **Journal of Urology**, 57:945, 1947.

Figures II, IV, V, VI. Walter, C. W., **Aseptic Treatment of Wounds**, New York: The MacMillan Co., 1948.

Figure VII. Courtesy, C. R. Bard, Inc.

Care and Sterilization of Rubber Gloves

By Carl W. Walter, M.D.,* and Dorothy W. Errera, R.N.

". . . That gloves of all things used in an operation should be of doubtful sterility is intolerable. . . . ."[1] and indeed unnecessary, considering the simplicity and ease of safe technics for preparation and sterilization.

Ethylene oxide sterilizers hold promise for simple, safe technics of sterilization at temperatures as low as 60° C. (140° F.), in which packaging and loading become secondary, and practically all factors necessary for sterilization are provided in automatic controls.[2]

Until these become standard equipment, however, hospitals must rely on steam sterilization with its few limitations and disadvantages, the latter being easily controlled in the case of specific items such as rubber gloves.

Rubber gloves are fabricated in a continuous process wherein porcelain forms are dipped into an aqueous suspension of latex and vulcanizing agents. The film of latex gathered on the forms is coagulated by immersing in an alcoholic solution of ascetic acid and curing salts. A second dip into the latex suspension precedes vulcanizing in warm, dry air. After the rubber has been set, the gloves are bleached in hot water to rid the rubber of soluble compounds.

SELECTION OF GLOVES

The chief factor to consider in selection of rubber gloves is use. When one realizes that more than 50 percent of new gloves may be punctured the first time worn,[3] it seems practical to purchase an inexpensive glove and discard damaged gloves. In a large institution, however, there is great need for rubber gloves in noncritical areas, and a repair program is worthwhile.

Mended gloves serve well in the fracture room and examining room, in communicable disease technics, and for many other purposes. Indeed, if the patching is skillfully done, most surgeons do not object to using repaired gloves.

Purchasing of gloves should be tuned to inventory, since aging contributes its share to glove deterioration. Maximum and minimum stocks must be set critically. Shelf storage should not exceed 12 months and should be at normal room temperatures away from sunlight, fluorescent lights, and generators. The last two cause formation of ozone which destroys rubber.

CARE OF GLOVES

Rubber itself is a hardy substance, resistant to alkalis or even moderately strong acids, but the non-rubber accessory substances in fabricated rubber products react unfavorably with a host of substances indigenous to hospitals. To list them all would be to list the stock of the average utility room. For example, gloves are dissolved by a solvent as common as benzol. Nitric acid, potassium permanganate, and hydrogen peroxide oxidize the rubber and end its useful life.

Rubber gloves are worn for bilateral protection—both the wearer and patient are isolated—and their use cannot be restricted by dictates of economy. The dangers of transmission of homologous serum jaundice make it imperative for the professional worker to wear gloves whenever blood or tissue fluids are likely to be contacted.

Proper use and care can control cost. Prompt and thorough rinsing of the gloves before removal minimizes residual contamination which may be destructive. Central processing by a proper technic prolongs usefulness.

This processing, with its costs and intricacies, is so susceptible to waste of time and supplies that it should be done under the supervision of a trained person in an area equipped with mechanical aids and personnel marshalled for the job. Economic advantage is achieved by the use of mechanical equipment wherever possible. Washing alone can be accomplished in less than 20 percent of the time necessary for washing by hand.[4]

PROCESSING IN LAUNDRY

Automatic washers range from the conventional domestic portable washer to institutional laundry equipment. Gloves can be successfully processed in the hospital laundry with the cooperation of the laundry manager. In one study, 98 percent of all gloves washed were acceptable for re-use, and tacky gloves were completely eliminated.[5] A lubricant drying mixture of ½-oz. of USP magnesium oxide powder (heavy) to 1 lb. of commercial cornstarch is thoroughly mixed and added to 10" of rinse water at 100° F. A flannel powder bag containing the same mixture is included in the drying phase, and the finished gloves are reported to be soft and of a uniform texture.

At the Peter Bent Brigham Hospital in Boston, a Westinghouse Laundromat has been converted to provide an economical, dependable means of washing and drying the entire glove supply of a 285-bed institution. A source of filtered warm air and a heating unit are the only requirements for the conversion.

Any turret-top vacuum cleaner, preferably with disposable paper fil-

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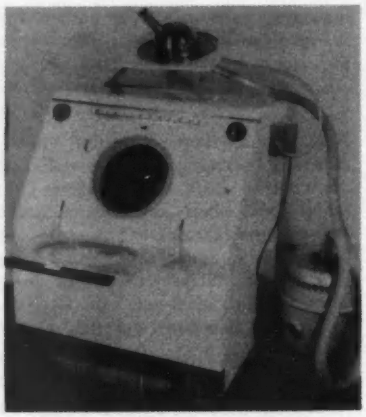


Figure 1

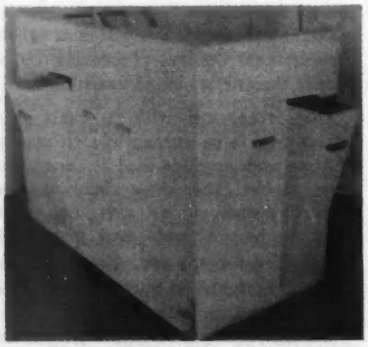


Figure 2

ter, provides the clean, warm air. A spare door for the washer, which can be obtained from the manufacturer, serves as the mount for the heating equipment and is hinged to the top of the machine in such a manner that it can be swung down into place during the drying cycle and folded back over the top when not in use (see Fig. 1).

A stainless steel disc, 10" in diameter, is mounted in place of the glass, and a pyramidal chamber which houses the inlet from the vacuum cleaner and holds the heating unit and wiring connections is silver-soldered to the disc.

A 6" stainless steel mixing bowl is either silver-soldered or spot-welded to the inside of the disc as a plenum chamber, and a piece of 1½" chromed pipe, 4½" long, is silver-soldered in place to direct the blast of air against the left upper quadrant of the rotating drum.

The machine is rewired so that the solenoid valves which normally fill the machine with water are inactivated when the heater is turned on, and the machine will continue to tumble the gloves into the blast of dry air for as long as desired.

New gloves are washed to remove industrial dusting compounds. If dermatitis apparently attributed to rubber gloves develops, much of the difficulty may be obviated by immersing new gloves for 15 minutes in a 5% solution of sodium carbonate.

Soiled gloves are gathered together and washed without preliminary sorting or handling. An alkaline detergent such as tri-sodium phosphate will not harm rubber, and solubilizes soil on gloves.

CONTROL OF TACKINESS

Gloves soiled with blood present as much of a hazard of transmitting the virus of homologous serum jaundice as a syringe, needle, or scalpel, and to protect personnel, the temperature of the wash water must be raised to at least 180° F.[6]

Tackiness of rubber gloves has been a problem in many hospitals. Contact with quaternary ammonium compounds and the synthetic detergents will cause tackiness in a subsequently sterilized glove. Avoidance of prolonged contact with these substances and prompt washing of used gloves in alkaline solution will control this type of deterioration.

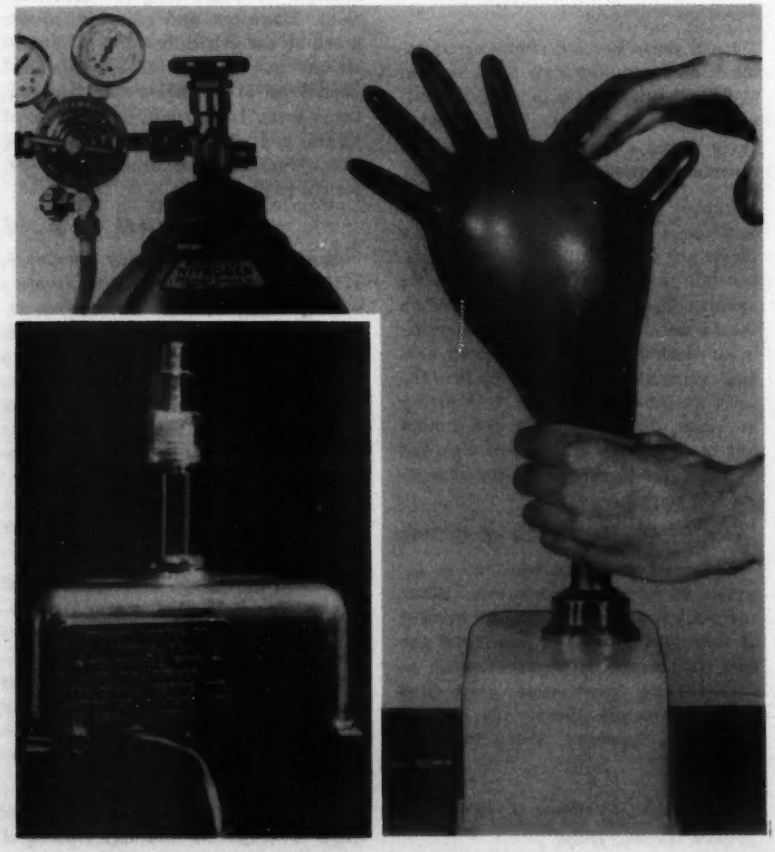
Addition to the rinse of the mixture of cornstarch and magnesium oxide, described above, will also render gloves soft and useful. One and one-half ounces of Bio-Sorb are added to the rinse cycle of the Westinghouse washer for the same purpose.

Gloves need not be turned during the washing technic described here and are removed from the washer ready for powdering.

In this procedure, mechanical aids are indicated for safety as well as economy. Markus decries the uncontrolled occupational hazards of conventional glove-powdering technics and describes the need for dust-collecting hoods in central supply rooms.[7] A simpler device is a rotating drum which powders the gloves uniformly, confines the dust, and uses a minimum of dusting compound.

Enough has been written of the granuloma-producing propensity of or-

Figure 3



Right: Lucite mold over which glove is fitted is shown in the insert at left of picture. Glove is fitted over mold at right.

dinary talcum and excessive amounts of amylase pectinate to make one realize that a minimal amount of dusting compound should be used.[8, 9, 10]

Gloves are dumped from the powdering drum on to a sorting table. The latter is a portable unit wheeled into position when needed and stored inconspicuously when not in use (see Fig. 2). It accommodates all the paraphernalia for testing, patching, and sorting gloves.

The best technic for testing gloves for punctures utilizes a machine to distend them with nitrogen. A lucite mold fitted on the handle of a control valve for the compressed nitrogen permits rapid inflation and inspection (Fig. 3). The glove is fitted over the lucite and the cuff is snugged against the mold. As downward or angular force is exerted on the cuff, the mold is illuminated, the glove inflated, and the puncture exposed and sealed with a daub of liquid latex. Patched gloves are set aside to dry for 48 hours. Intact gloves are sorted into appropriate bins.

GLOVES ARE HYDRATED

Gloves of one size, ready for packaging, are emptied from a bin and packaged for sterilization (Fig. 2). A muslin folder with integral tab is used, the latter being positioned inside the glove to allow for an exchange of air and steam in the sterilizer. The folders and gloves are hydrated with a fine spray of distilled water and then wrapped in a double-thickness muslin wrapper (Fig. 4).

The economy of paper wrappers is a matter for individual consideration; the bacteriology of paper wrappers, however, is a matter of universal concern, and no choice should be made until bacteriologic evidence is presented that the wrapper is not a barrier to steam penetration in the time allotted for sterilization. It must be fabricated and packaged to eliminate channels, such as stitch holes, through which bacteria might gain access.

No discussion of steam sterilization is complete without a word of caution about superheating.

An exchange of energy—heat measured in calories—occurs during the transition from the vapor state to being fixed in the fiber.

In the sterilizer, a volume of hot steam meets a hydrated, cold package. The steam contacts the package, condenses, and in doing so, provides the moisture essential for sterilization. The energy released by the change of state also heats the package. The amount of water deposited is limited by the demand for energy to heat the package to sterilizing temperature.

On the other hand, when a dehydrated package is placed in the sterilizer, the textile, paper, or rubber extracts moisture from the surrounding steam to satisfy its thirst in such quantity that an excessive amount of energy is liberated. Besides heating the package, the extra heat superheats the surrounding steam and drives it into a temperature range so that it has the bactericidal properties of dry rather than moist heat. This same extra heat also chars textiles and reduces their tensile strength.

No automatic control can prevent superheating. Enough moisture must be supplied before sterilization to avoid the plundering of the steam. Textiles fresh from the laundry are moist enough for safe sterilization. In humid climates, there is no problem of supplying moisture, but wherever textiles or rubber goods are allowed to dry out in storage or in steam-heated rooms, moisture must be provided immediately before sterilization. This is easily done with a spray of distilled water. There need be no perceptible wetting of the articles to ensure safe sterilization.

NECESSARY PRECAUTIONS

A few additional precautions are necessary in the sterilization of rubber goods to avoid destruction. Oxygen, which destroys rubber, is present in the residual air which pools in the bottom of the sterilizer. Hence, rubber goods are positioned in the upper third of the sterilizing chamber.

Because excessive heating takes its toll of rubber goods, these items should be sterilized alone or with similar small packages so that they are not exposed to the prolonged heating necessary for the penetration of large packages. Also, they are removed promptly from the sterilizer at the end of the cycle.

All the care in washing, packaging, hydrating, in the endeavor to achieve sterile gloves, can be frustrated by improper positioning of the packages in the sterilizer. Sterilization of these packages occurs by penetration of the wrapper by steam and direct contact of all the glove surfaces. This is initially made possible when the glove surfaces are separated by the tab of the envelope; it is ensured when the gloves are placed in the sterilizer—in one position only—horizontal, the gloves standing on edge with the thumbs uppermost. In this way steam enters the inside of the glove at the same time it contacts the outside. Condensation occurs on both surfaces to provide the moisture essential for sterilization.

Gloves cannot be sterilized atop each other because compression of the bottom of the pile prevents access of steam. They cannot be sterilized standing on finger tips because the inverted glove pools air which cannot escape; hence the inside of the glove remains dry and unsterile.

They cannot be sterilized standing on the cuffs. In this position, steam contacts the cold outer surface of the glove, condenses, wets and heats that surface. By the time it creeps under the dependent cuff into the glove, the

Figure 4

inner surface is warm, the steam does not condense, and the conditions prevailing are those for heat sterilization which requires longer exposure than that allotted for steam sterilization.

GLOVES SHOULD BE STORED

Gloves can be sterilized at a standardized 30 minutes at 121° C. (250° F.) without undue destruction if the load is limited to rubber goods or small packages.

Tensile strength of rubber is temporarily lost in heating but is regained on drying. Hence, sterilized gloves should be stored for 48 hours before use.

When stored in a cool, clean, dry, vermin-free place, packages wrapped in double-thickness muslin can be considered sterile until used. Resterilization is an expensive, time-consuming, illogical process which hastens deterioration of supplies, since proper precaution is seldom exercised to ensure hydration of the materials. Intelligent inventorying to keep supplies current can eliminate the stress of this perennial problem.

In disaster planning, prolonged storage of sterile gloves is feasible. The sterilized supplies should be packaged in an impervious material for protection against inevitable collections of dust and chance contact with moisture. Again, storage should be at room temperature or less, out of direct sunlight, and away from fluorescence or ozone.

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How to Prolong Life of Your Hypodermic Syringes

By Kenneth K. Andersen*

Each year hospitals throw away hundreds of thousands of syringes because of leakage and disappearance of markings. Laboratory tests have revealed that this great loss of syringes is caused by the dissolution of glass from a high alkali content in the detergents used for cleaning them.

Problems in our hospitals during recent years have created a demand for fast-acting cleaners, and this demand has tended to make detergent manufacturers increase the alkali content of their detergents. While detergents of high alkaline strength may be fine cleaners and non-injurious to metal instruments, they rapidly ruin hypodermic syringes. The central supply staffs of our hospitals can prolong the life of their syringes by the use of simple tests that determine the alkaline strength of detergents and thus prevent leakage and disappearance of markings.

Leakage of liquid between the barrel and plunger is called backflow, which is caused by a loose fit between the parts. This looseness need amount to only a few ten-thousandths of an inch for leakage to occur.

It may seem that this loose fit would be caused by a rubbing together of the parts which would finally wear away enough glass to cause leakage. However, normal usage does not cause hypodermic syringes to wear out. Laboratory tests have shown that a syringe would have to be used about 10,000 times before it would wear to this point. This amounts to once a day for 27 years.

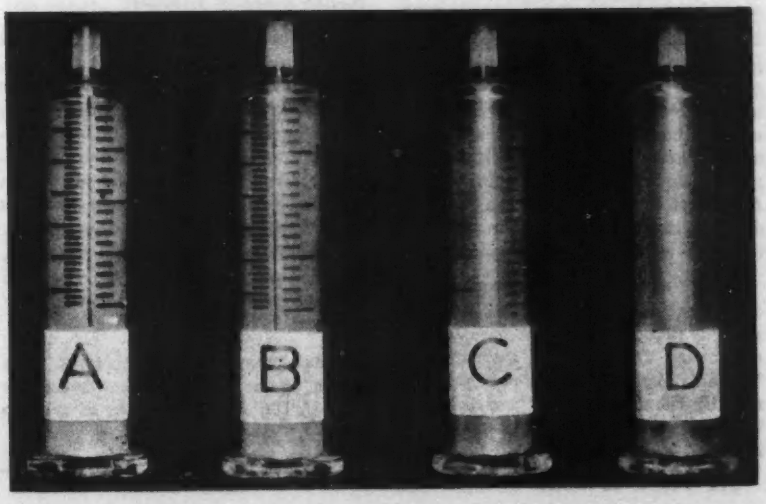
Research in the problem of leakage has been made in another area: dissolution of the glass. This dissolution would also explain the gradual disappearance of the markings. The lines and numbers on present-day American syringes are not merely painted on the surface; they are made a part of the glass. Therefore, they are as durable as the glass itself—they cannot wear off. The only way to remove these markings is to dissolve the glass.

Laboratory tests have shown that this dissolution of glass is a result of alkali attack by highly alkaline detergents. Too much alkali dissolves the glass, thus removing that portion which contains the markings and giving a loose fit between the barrel and the plunger.

Alkali attack on hypodermic syringes occurs widely in many hospitals. From a recently collected sample of 744 syringes discarded by one of Ohio's leading hospitals, 96 percent were found eroded by alkali to such an extent that they were not usable. Glass, especially the high-grade resistant glass used to make hypodermic syringes, is generally considered corrosion-resistant or impervious to attack by most chemicals. However, glass experts know that it is not as corrosion-resistant as is generally believed.

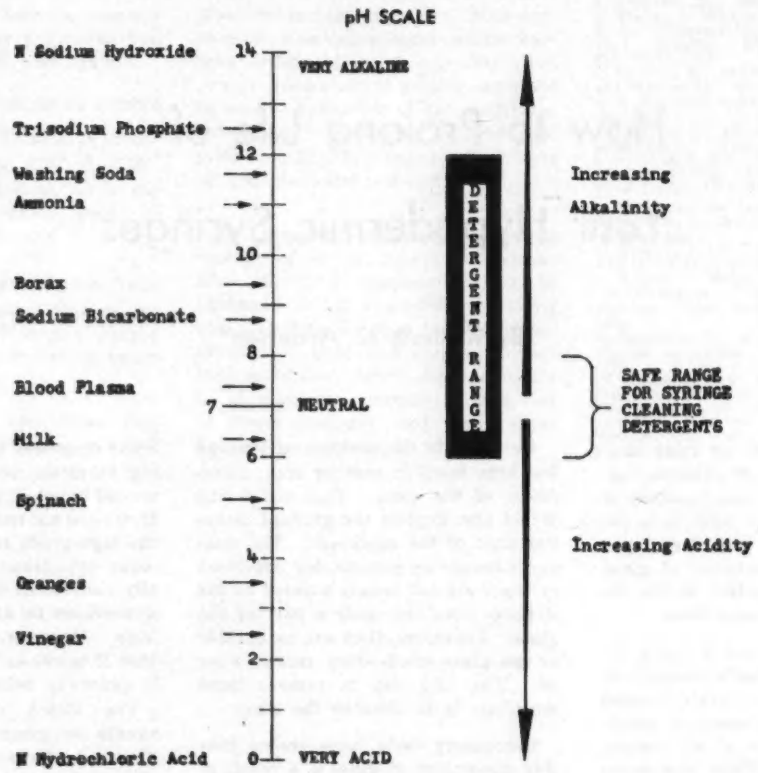
The attack of various chemical agents on glass is called "etching." Figure 1 shows examples of etching of hypodermic syringe barrels. Syringes B, C, and D were etched by alkaline solutions, while syringe A was never subjected to any alkali. It is evident that the markings became lighter as the glass dissolved. Syringe B was boiled in only 0.4% sodium hydroxide, yet it was eaten away so much that the syringe failed the Federal Specifications pressure test. Syringe

Figure 1



*Mr. Andersen is a National Science Foundation Fellow doing graduate work at the University of Minnesota on his doctorate degree in chemistry. He is also a member of the technical staff of Knox Laboratories, Inc., specializing in glass research.

Figure 2



D, completely etched, was boiled for three hours in a 4% sodium hydroxide solution, which is a diluted solution. Syringe C shows intermediate attack.

Thus, only a small amount of alkali dissolves glass, causing markings to disappear and syringes to backflow. Soaking overnight in a lye solution or in similar strong acids would do this. Fortunately, syringes are seldom subjected to this damaging treatment, because lye or strong acids are rarely used to clean them. Yet syringes are often given treatment just as harsh and injurious. Unknowingly, many people use strongly alkaline detergents for cleaning syringes, not realizing the damage they are doing over a period of a few weeks or a few months.

This is not the fault of the people in charge of cleaning, because strongly alkaline detergents are frequently recommended for surgical instruments. These detergents are fine cleaners and non-injurious to metal instruments, but they rapidly ruin hypodermic syringes.

The extent to which syringes are damaged depends on the alkaline strength of the detergents, which varies considerably. This variation is expressed scientifically in pH units. Figure 2 shows a pH scale and the pH values of some common substances. Detergents usually fall in the range of 6 to 12. A high pH number means a high alkaline strength.

To ascertain to what extent various commercial detergents affect syringes, the following tests were made. Water solutions of those detergents used to clean syringes in hospitals were prepared according to the detergent manufacturers' directions. The pH values or alkaline strengths of these solutions were then measured with an instrument called a pH meter. However, Hydrion pH Test Papers** can be used to quickly determine the approximate strength.

After the pH measurement was taken, the solution was then heated to 176° F. (80° C). A number of syringe barrels were placed in these solutions and soaked while they were being constantly shaken mechanically. The syringes were removed from the solution every few days in order to measure the extent of the alkali attack.

These measurements were made within twenty-millionths of an inch (0.000020 in.), using a precision measuring device called an air gauge. Then they were returned to the solutions for a period of a few more days, and the measuring was repeated. This was done several times.

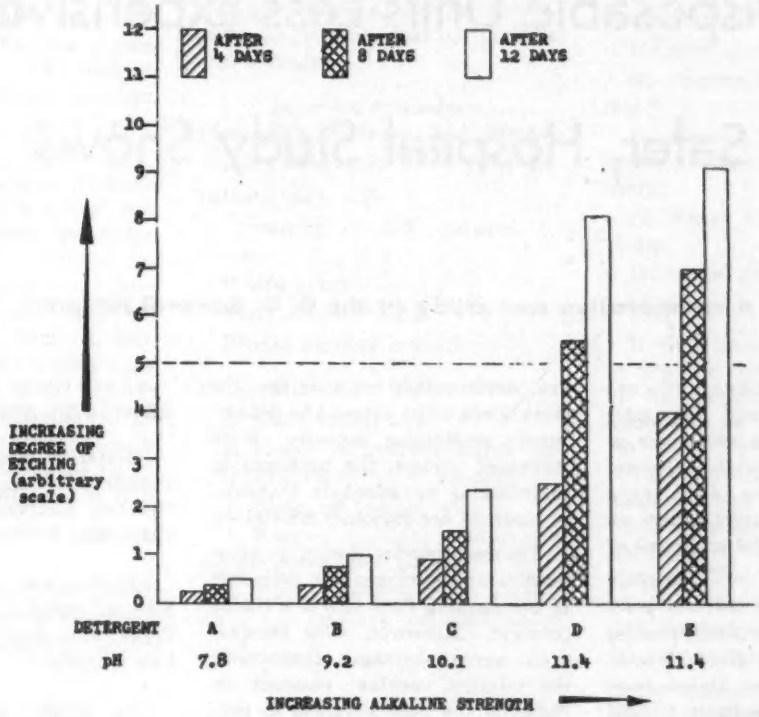
Figure 3 shows some of the findings. It is evident that the detergents with the high pH values—the strongly alkaline ones—etched the glass much more severely than the weakly alkaline solutions. The etching became worse as the temperature was raised.

If a hospital cleaned its syringes by soaking overnight in a hot solution of detergent D or E—and many hospitals do—severe etching would occur in less than a month; in fact, these syringes would backflow so badly that they

**Manufactured by Micro Essential Laboratories, Brooklyn, N. Y.

Figure 3

Etching of Syringes By Various Commercial Detergents



would be useless. On the other hand, a mild, nearly neutral, non-alkaline detergent like A would not etch the syringe in a comparable period of time. Several detergents like A are available on the market.

In order to be sure that the detergent you are using will not shorten the life of your hypodermic syringes, measure the pH of your cleaning solution, using Hydrion pH Test Paper. It is supplied in rolls like ¼" adhesive tape and can be obtained at any chemical supply store.

When a small strip of the paper is dipped into the detergent solution, the paper turns color. This color is compared to a color chart supplied with the paper. The color indicates the pH of the solution. If the pH is higher than 8.5, it would be wise to use another detergent, one with a pH between 6 and 8. These low pH detergents clean syringes just as efficiently as the more alkaline ones, but they are much less injurious.

Selection of a "neutral" detergent, one with a low pH, will save hospitals hundreds of thousands of hypodermic syringes each year.

Disposable Units Less Expensive, Safer, Hospital Study Shows

A comparative cost study at the D. C. General Hospital

*The following comparative cost study of reusable and disposable needles and syringes was made at the District of Columbia General Hospital, Washington, D. C., as a part of a comprehensive report on the health and hospital programs of the community.**

It should be noted that the present cost of using reusable needles and syringes at the D. C. General Hospital is somewhat higher than the cost which is probably typical of general hospitals. This would be due in part to the large percentage of sterilized needles and syringes which are not actually used in injections. Also contributing to the high cost are inadequacies in space, space utilization, and equipment.

Because of the growing importance of the development of prepared sterile supply items, HOSPITAL TOPICS will attempt to obtain and publish further studies in this area.—THE EDITORS.

• One of the critical functions of the central sterile supply department is the preparation and use of sterile needles and syringes. The use of injections has increased manyfold over the past 20 years. Today, there are few patients who do not, during their hospital stay, either receive injections or have blood withdrawn by use of a sterile needle and syringe.

With the expanded use of all sterile items, the demands on central sterile supply are such that the work loads often exceed the department's production capacity. With increased volume, the problems in maintaining an adequate standard of sterility are obviously multiplied.

The maintenance of sterility after needles and syringes are delivered to the nursing floor also is a major problem. Moreover, with tremendous nurse shortages throughout the country, constant research on reducing the time required to perform nursing tasks is a must.

At D.C. General Hospital the volume of sterilization has increased to the point that either the work load must be reduced or sterile supply units must be enlarged. A study was made of the use of disposable needles and syringes as a possible means of reducing this work load.

METHODS

A large quantity of disposable needles and syringes for this study was obtained from Pharmaseal Laboratories.** These needles and syringes consisted of a single unit of plastic syringe and attached needle wrapped in a cellophane airtight package. The entire unit was completely sterile, as determined by laboratory tests.

The combination needle and syringe was tested under controlled conditions and compared, both for effectiveness and cost, with the present system involving reusable needles and syringes.

This study was approached in three ways:

•Analysis of nursing time and effort of the two systems.

•Detailed cost studies of all elements of expense involved in the two systems, including nursing time.

•Evaluation of attitudes and medical opinion as to the advantages and disadvantages of the two systems.

The study was accomplished largely through the co-operative efforts of the nursing service, the accounting office, and the medical staff.

The two methods studied may be described as follows:

1. Present method — reusable needles and syringes:

In the present procedure, there is not a single central supply; there are several separate units operated by the various services—medicine, surgery, and obstetrics. Syringes and needles are sent in packets several times a day from the central sterile supply units to the various services.

The procedure developed as a standard by the nursing service was devised to assure maximum protection of the patient against infection. It is, however, time-consuming. With the limited number of supervisors available, there is a tendency for individual nurses to develop quicker, though less safe methods of preparation. It was found that the standard was seldom followed and that a "short-

*Survey of Municipal Hospital Facilities of the District of Columbia, by Isadore and Zachary Rosenfield, architects and hospital consultants, and by John G. Steinle and Associates, management consultants to institutions.

**Stylex expendable hypodermic syringe—2cc.

cut" method was consistently used, as is evident in the chart headed "Recommended and Actual Procedure."

The actual method used was much more rapid than the recommended procedure. The maintenance of sterile technic, however, may be somewhat open to question.

One very interesting side development from this study was the discovery that there was a substantial difference between the number of syringes sent from central sterile supply and the number of actual injections. Only 54.2 percent of the sterile needles and syringes were actually used. A large proportion of the remaining were contaminated in handling, A number were defective—the needle was bent or dull.

2. Expendable needles and syringes:

The nurses themselves quickly developed an effective procedure for the use of expendable needles and syringes. The needles and syringes were attached and packed in cellophane packets. The following simple and safe method was quickly developed for use of these single-unit attached needles and syringes.

Injection Procedure
Disposable Syringes and Needle

Remove medication card from file

Collect tray with:

Container of 2x2 sponges in alcohol
Waste basin
Vials of medication
Proper syringe packets.

Preparation:

1. Wash hands
2. Place requisition cards on tray with container of sponges
3. Clean off tops of vials
4. Remove syringe, needle, and needle cover from packet
5. Twist plunger into barrel; then put syringe on medication card
6. Remove needle cover
7. Insert air; then withdraw medication from vial
8. Replace needle cover and place on medication card on tray
9. Carry tray to bedside
10. Prepare injection area; then inject
11. Replace needle cover; then break syringe and put in waste basin
12. Wash hands between patients
13. Clean up
14. Chart.

It was found that it was easy to slip the completed syringe out of its packet. A new technic seemed to be required to push in the barrel the first time, but the nurses quickly made this adjustment. It was also found that the plastic tip served as the sterile needle cover instead of the 2x2 sponge. The expendable needles were sharper than reusable needles even after they were inserted into vials of medication.

The number of expendable needles and syringes used closely approximated the number of injections actually given. This, of course, is attributable to the fact that none of the expendables was found defective.

Recommended and Actual Procedure

RECOMMENDED METHOD	ACTUAL METHOD
Remove medication card from file	Remove card from file
Collect tray:	Collect tray:
Sterile towel	None
Basin for waste	Basin
2x2 alcohol sponges in container	2x2 sponges in basin (not in container)
Sterile lifting forceps	(Forceps used by most nurses)
Preparation:	Preparation:
Wash hands	Same
Open towel, place on tray, fanfolded	Omitted
Cleanse vial with alcohol sponge	Same
Remove syringe with forceps	Most use forceps
Place 18G needle on syringe with forceps	20G needle attached to syringe
Insert air and withdraw medication	Same
Detach syringe from needle	Omitted
Attach 20G needle, then put inside towel	Omitted
Place medication card under syringe	Same
Place 2 2x2 sponges on tray	Syringe and needle encased in 2x2 sponge
Carry tray to bedside	Same
Wash hands between patients	Not done
Clean up	Same
Chart on Kardex	Same

ANALYSIS OF COSTS

The following questions had to be resolved in order to achieve an effective determination of comparative costs:

- How much is it costing the hospital for each intramuscular and hypodermic injection?
- How much would it cost to use the disposable syringe and needle combination?
- For cost-accounting purposes, is the central supply service being properly credited for its actual costs?
- Is there an unnecessary waste of effort at any stage in the procedure?

To find the answers to these questions, the following assignments of responsibility were made:

The central supply services of medicine and surgery determined:

Time of collecting and distributing

Time and cost of cleaning, assembly, and sterilization of syringes and needles

Total needles and syringes issued as compared with the total amount of injections.

The comptroller's office, which includes purchasing, receiving, and cost accounting, determined:

Total cost of materials used in the injection procedures

Percentage of manufactured items actually used

Loss by breakage and theft

Cost of each injection.

All basic data were obtained from detailed time and motion studies made under actual working conditions. A normal distribution of 2-cc. reusable and expendable needles and syringes was used. It was found that a continuous study of eight days was necessary in order to obtain sufficient data for accurate conclusions.

1. Present method:

The first step in the analysis was to determine the total time and cost involved in the collection, cleaning, processing, and sterilizing of needles and syringes. The total costs involved were divided by 600, the average number issued per day, to obtain the cost per set of needles and syringes issued, and by 325, the number of injections given, to obtain the actual cost per injection.

The steps taken in central sterile supply, the time and cost involved per step, total times and costs, and unit costs are summarized in Exhibit 1.

Central sterile supply syringe costs were found to be $0.076184 per injection. An additional cost results from the necessity to assign extra help every two or three days to process the accumulation of needles which had remained in surgical cleaner.

The processing cost in sterile supply closely approximates the results of a similar study, the report of which was recently published.

Detailed analysis of nursing service operations in the giving of injections resulted in a determination that the nursing personnel costs are $0.06265 per injection. The procedure, time, and cost factors used in making this determination are summarized in Exhibit 2.

The following table summarizes the annual costs of all materials used for injections:

Present Method
Annual Cost of Supplies, Materials

Syringes	$6,579.40
Needles	4,081.43
Ether	1,060.72
Cotton	40.20
Applicators	38.76
Rubber bands	28.19
Constriction tubes	369.06
Gauze	103.15
Surgical cleaner	316.24
Linen wrapper and packets	965.00
TOTAL	$13,582.15

In the entire year there were 219,000 syringes and needles processed. The eight-day detailed study showed that 54.2 percent of the sterilized needles and syringes resulted in injections. Therefore, the use annually would be 118,698 needles and syringes for actual injections. Thus, the material cost per injection is $0.1144 (the annual material cost of $13,582 divided by 118,698 injections).

The cost per injection by present methods may be summarized as follows:

Summary of Unit Costs
Per Injection by Present Method
Reusable Needles and Syringes

Central sterile supply labor costs	
Syringe care	$0.07618
Needle care	0.02541
Nursing service labor costs	0.06265
Supplies	0.11442
TOTAL	$0.27866

Additional costs not included in the survey but which might be considered by cost-accounting procedures in some hospitals might include:

Fringe labor costs such as:

Factor.	Percentage of Annual Labor Costs*
Social Security	2.5
Unemployment insurance	3.2
Sick leave	4.3
Workmen's Compensation	1.1
Free or reduced hospitalization	2.4
Two-weeks' vacation	4.3
Six paid holidays	2.6
TOTAL	20.4

*A national average based on hospital studies.

On a direct labor cost of 16 cents, 20.4 percent fringe labor cost comes to over three cents additional.

Overhead costs, such as space and utilities, devoted to needle and syringe processing.

2. Expendable needles and syringes:

The method of study of the disposable syringe procedure followed the method used in analyzing the present procedures. The total cost was determined by labor time in injection and cost of supplies.

Exhibit 3 summarizes the findings.

In the instances observed the number of needles and syringes used corresponded with the number of injections. There were no contaminations in the procedure.

It was interesting that the clean-up time for injections decreased materially, while the time of preparation increased slightly. Upon observation it was discovered that opening the packet of syringes was a new procedure for the nurses and would require experience before maximum proficiency could be attained.

A thread that would simplify the opening of the packet would cut the preparation time considerably.

—MEDICAL FACTORS, ATTITUDES

After the syringes were assembled the tray was taken to the patient's bedside. An efficient and

Exhibit I

Present Method

Central Supply Services—Costs per Injection

Operation and Average Time (seconds)		Seconds
Collecting (a)	Total—1 trip	4,401
	80% of time spent collecting injectables	3,300.75
	Trips { 2 to medicine / 2 to surgery }	13,203
TIME: 40.6246	(325) Injections given	40.6246

	Observed No. of Syringes	Total Time	Average Seconds
Syringe packaging			
Sorting	193	370	1.9171
Washing	325	2082	6.4061
Preparing	204	900	8.7009
Assembly	144	1295	2.9167
TIME: 36.8107	Labor time per syringe—		19.9408
	Labor time per injection- (325) issued 600		36.8107

	No. of Needles	Total Time	Average Seconds
Needle packaging			
Cleaning with water	170	1320	7.7647
Cleaning with ether	241	3122	12.9543
Assembly	144	1218	8.5183
	Labor time per needle—		29.6773
TIME: 54.7888	Labor time per injection- (325) issued 600		54.7888

		Trips	Breakdown	
Loading		2	231	461
Unloading sterilizers. 2.883		2	238	476
				937 seconds
	Time per injection			2.883
Loading trucks for distribution	2.0370	4	331	1.324
	50% for syringes and needles			662
	Labor per injection (325)			2.037
Distribution (a)		4	4401	17.604
	50% for syringes and needles			8.802
27.083	Labor per injection (325)			27.083
Total time per injection				164.2271
Labor cost per second				$ .0004639
Labor cost per injection				.076184

(a) Statistics are based on average time of 4 minutes 26 seconds. In an individual time study, attendant spent 33 minutes 4 seconds on one ward rewrapping syringes. There also were delays in the trips to the floors collecting and distributing. Elevators were at floors.

sympathetic bedside manner toward the patient was observed in all cases. Needles were inserted with efficiency.

Municipal hospitals have a very high proportion of older patients. These are always the most difficult to inject, because they are sensitive and often they have received a high number of injections and their tissues have deteriorated.

With the present method, patients generally winced when injected. The universal reaction of the nurses on the floors can be summarized in the following statement: "There are too many loose and plugged syringes, and the needles are poor. It is hard to get deep penetration."

Patient reaction to use of the disposables was very good. There were no complaints and few comments beyond a passive, "That was all right."

The reaction of the nurses was enthusiastic, especially on the following points:

- After the injection the needle is snapped off, and that is the extent of the clean-up.
- The needles are much sharper.
- The syringe is tight and easy to work with.

There is no question that the nurses much prefer the disposable needles and syringes to the present, traditional method.

The chief of staff was of particular assistance in making a medical evaluation of the two systems. Unquestionably, everyone connected with a hospital must be concerned with cost factors. However, cost must be secondary to the concern that the physician must have for:

The possible dangers of infection and cross-infection through the use of contaminated or dull needles or inadequately cleaned syringes.

The possibility of hepatitis being transmitted through inadequate procedures.

All elements which relate to the comfort and well-being of the patient.

In order to determine the safety of the use of disposable needles and syringes, it was necessary for

Exhibit 3

Disposable Syringe and Needle Cost per Injection

Labor Time In Injection	Time (in seconds) Per Procedure	Observed	Total Seconds
Preparation	64.162	370	23740
Injection	34.323	370	12700
Clean up	2.970	370	1100
Seconds per injection	101.455		
Labor cost per second	$0.00049		
Basic labor cost per injection	0.04959		
10% differential (evening-night)	0.00330*		
Total labor cost per injection	$0.05289		
Supplies	0.15		
Purchase overhead (per injection)	.003	(estimated 1/3 present cost)	
Cost per injection	$0.20589		

*Injections, which include sedation, are given in approximately equal numbers on day, evening, and night duty.

members of the medical staff to review the present operations and to observe the methods employed in the use of expendables. The review of present methods and of patient records indicated that it is exceedingly difficult to determine the source or cause of infection. There are, however, some obvious considerations:

—Certain types of infection have increased in direct proportion to the number of injections.

—There may be indications in a patient's record which lead the physician to believe that an infection probably was caused by an injection.

Also of substantial significance is the incidence, with present methods of injections, of sore arms, patient complaints, and headaches following the injection of drugs that cannot possibly have toxic effects. The physician is immediately suspicious of injections in these cases, particularly when he observes the tremendous possibilities of contamination that exist in the traditional methods.

The exact extent to which expendable needles and syringes will reduce infection cannot be stated at this time. Much more observation is necessary before a positive statement can be made. The general medical opinion was that the reduction of infection after the use of disposables will shed substantial light on the extent to which the traditional methods of injections are responsible for primary and secondary infections.

Several members of the staff expressed the opinion that expendables will go far to solve the problems of injections but that there is one danger in their use. In a municipal hospital precautions must be taken to assure that the needles and syringes are destroyed after use and that they do not find their way into the hands of the illegal narcotics user or vendor.

CONCLUSIONS

Disposable needles and syringes have the following advantages over traditional needles and syringes:

- They reduce the cost per injection.
- They are preferred by nurses.
- They are not as apt to make the patient uncomfortable.
- They provide less opportunity for contamination and infection to the patient.

Study Finds Time, Money Saved With Disposable Units

By Carl I. Flath*

• A time and cost study comparing the present method of syringe and needle preparation and intramuscular administration procedure with a method utilizing disposable syringe units was undertaken by the nursing department at the Pontiac (Mich.) General Hospital, at the request of the director.

The study of administration procedure was carried out on the medical (62-bed) and surgical (61-bed) wards. The anticipated study was discussed well in advance of the actual time set for it, in head nurses' and supervisors' meetings and in the floor areas. The nurses were curious about the disposable units and were very willing to participate in the study.

A week was spent in the observation of each method. We conducted the study on the day shift, with our instructors acting as observers, and on the afternoon shift, with the graduate nurses timing themselves. Along with the reaction to the syringe, we were anxious to observe the nursing technic and patient's reaction.

PRESENT METHOD

At present our 2-cc. syringes and needles are sent to the floors in the same boat, in accordance with floor standards. There is always an adequate supply; deliveries are made three times daily.

Preparation, Injection, Cleanup:

Each floor was using a different method of preparation. The nurses on the second floor carried the boat into the patient's room. Fourth-floor nurses prepared the injections in the treatment room. After both methods were observed, an alternate method was recommended for use with the present reusable syringe and needle:

1. Check R_x card against Kardex.
2. Place card on tray.
3. Prepare R_x.
4. Draw up R_x in treatment room.
5. Lay on tray with alcohol sponge.
6. Go to bedside.
7. Identify patient.
8. Administer R_x.
9. Clean up tray.
10. Chart.

Note: Use alcohol sponge to wipe fingers between patients.

Because the procedure of preparing the medication at the bedside sometimes has an adverse effect on the patient, it was decided that the injections should be prepared in the treatment room.

Nurse and Patient Reactions:

Patients occasionally complained that the injection hurt.

The general complaint of floor nurses was that the needles plugged before the administration of the drug, and it was often necessary to change needles before injections. (This is the reason the second-floor nurses carried the medication to the bedside to prepare it.) The cleanup is done by an aide, who rinses the syringes and needles in preparation for their return to the central supply department.

DISPOSABLE SYSTEM

The following procedure for preparation and injection was used with disposable syringe† units:

1. Wash hands.
2. Assemble equipment.
3. Clean tops of vials with alcohol sponge; discard sponge.
4. Remove syringe, needle and needle-holder from packet; twist plunger in barrel to free it.
5. Remove clean alcohol sponge from container and place on table, clean side up.
6. Remove needle cover from syringe; place on clean alcohol sponge so as to keep open and uncontaminated. Check needle for tightness.
7. Fill syringe with air.
8. Insert needle in vial; force air from syringe into vial and withdraw proper amount of medication.
9. Remove needle from vial and pull plunger back until bubble of air enters the syringe.
10. Replace needle cover over needle, leaving plunger pulled back as above.
11. Put filled syringe on proper medication card.
12. Fill number of syringes needed; place on tray and wash hands.
13. Carry tray to bedside.
14. Identify patient and explain procedure.
15. Inject medication.
16. Replace needle cover and break syringe in two. Discard broken syringe and used needle in waste container on tray.

*Associate consultant, John G. Steinle and Associates, Garden City, N. Y.

†Stylex expendable hypodermic syringe—2 cc., Pharmaseal Laboratories, Glendale, Calif.

17. Cleanse hands with clean alcohol sponge between patients. Discard sponge each time.

18. Clean up tray.

19. Chart.

The nurses soon began using the plastic tips to cover the needles when carrying syringes to the bedside.

Nurse and Patient Reactions:

The patients made no particular comment.

The nurses' principle objection to the disposable syringe unit was that the needle was larger. They have been using #22 needles; the unit had a #20 needle. It was necessary to watch more closely for oozing at the site of injection. However, the consensus among nurses after they used the disposable syringe was that they much preferred it because the needle was always sharp.

The larger needle made it easier to draw heavy medications into the syringe. Although nurses would rather have a #21 needle, they prefer disposable syringes and needles to the old type, even with a #20 needle.

There was much favorable comment from the medical staff, many of whom expressed a desire to purchase the syringes for their own use.

REMARKS

1. Needles were cleaned by machine and all plugged needles set aside in CSR for further check and recleaning. Complaints or reasons for rejections on floors were that needles were not sharp or were plugged by medication after dosage was withdrawn. Clearing the needle of medication would eliminate the latter.

NURSING SERVICE

Cost Study — Reusable Syringes

Areas studied:
Second floor—surgical
Fourth floor—medical

Time and Method:
5 successive days
7-3 shift—observer timed procedure
3-11 shift—nurse timed herself
Work sheets designating factors to be timed were provided.

	7-3	3-11	Remarks
Total number injections	144	146	
Average time preparing each injection	64.5 sec.	31.8 sec.	More interruptions on 7-3
Average time giving each injection	99.0 sec.	94.1 sec.	Dosage prepared in medicine room on 3-11
Disassembling syringe	13.2 sec.	13.2 sec.	3 syringes discarded
Total	176.7 sec.	139.1 sec.	

Over-all total

Total number injections	290
Preparation time	51.5 sec.—each injection
Giving injection	96.5 sec.—each injection
Disassemble	13.2 sec.—each injection
Total time	161.3 sec.—each injection

Nurse's salary (1-year level—$2.11 per hr.) $.00058 per sec.
Differential $.000014 per sec.

Cost per injection $.00058 on all injections
plus $.000014 for 146 given on 3-11
Total cost $.0946831 per injection

Cost Study — CSR Processing

Unit of study—1 syringe and needle
(Processing unit—1 boat of 12 syringes and 13 needles)

Procedure:

1. Syringes and needles collected from each area by CSR personnel using carts.
2. Returned to CSR and sorted.
   (a) Needles soaked in detergent. Cleaned in needle-cleaning machine. Burrs removed. Booked on gauze squares for boats.
   (b) Syringes washed in syringe-washer. Assembled and put in boats.
3. Autoclaved.
4. Distributed to floors by CSR personnel as requisitioned and put away on floors in designated areas.

Collection and travel from CSR to floors and return ..... 232.5 sec.
Sorting and cleaning ..... 20.5 sec.
Packaging ..... 16.57 sec.

Autoclave	21.8	sec.
Distribution	130.0	sec.
Total per unit	421.37	sec.

Average number processed per day—328 units

Worker's salary—$1.60 per hr. or $.00045 per sec.
Differential $.000014 per sec.

Cost of processing one unit $.00045 per sec. on all units
plus $.000014 for 164 done on 3-11 and 11-7 shifts

Total labor cost per unit $.19256609

Cost of Supplies—Reusable Syringes

		Cost Per Unit
Needles—No. 22:		
Average number dispensed per month 7,025		
Replacement 216		
Each needle used 7,025/216 equals 33 times		
Purchase cost—$1.84 per doz. or $.153 each		
Cost per usage:	$.0046	
No. 24 Needles—cost per usage	.0052	
No. 21 Needles—cost per usage	.0046	
	$.0144	
Av. cost of 1 needle per usage $.0144/3	equals	$.0048
Syringes—2 cc.:		
Average number dispensed per month 10,000		
Average number replacements 66		
Each used 10,000/66 equals 151.5 or 152 times		
Purchase cost—$1.46 per each		
Cost per usage—$1.46/142	equals	.0096
Other materials:		
Gauze—Purchase cost $.009 each		
3 used in each boat of 12 injection units		
Cost per injection $.009 x 3/12	equals	.0023
Cleansers:		
Arex—Purchase cost 1 T. equals $.0291		
Use 6 gal. solution daily (1 T. to gal.) equals	$.1746	
Av. number units washed daily—328		
Cost per injection—$.1746/328	equals	.00053
Alcohol—Purchase cost—$.66 per gal.		
Daily use—1 gal.		
Cost per injection $.66/328	equals	.0020
Compressed air—$1.03 per day:		
Cost per injection—$1.03/328	equals	.0031
Ether—1 can per week		.006
Cotton—Cost $2.12 per 1,000—each $.0021		.0021
Steriltape—$.96 per roll—per unit $.96/328	equals	.003
Stone for removing burrs, Distilled water, Autoclave, Boats	Estimate only	.005
TOTAL		$.03843

Cotton balls and alcohol used for skin cleansing on floors not included. Same amount for each method.

Thirteen needles were put in each boat; so one needle was always not used or rejected. This would amount to 15 in the 290 injections studied, or 5.2 percent. Discarded needles were counted in replacement figures used, or average of 3.07 percent.

2. Syringes were also washed by machine and rinsed in distilled water. They were rarely rejected because of sticking. Multifit syringes eliminated mismatching. Only three syringes were rejected in the 290 injections studied, or 1.04 percent. (This figure will vary from hospital to hospital, depending on the cleaning method used. At Pontiac General Hospital, the needles and syringes are machine-washed. The number of rejects is accordingly very low.)

Broken syringes were counted in replacement figure used, i.e., 66 per 10,000 syringes.

CONCLUSIONS

1. There were savings in both time and cost when disposable syringes were used:

Time — 15.4 seconds per injection.

Cost — approximately 10 cents per injection.

2. The technic of administration was much better when the disposable syringes were used.

3. Patients made no particular comments with respect to either method.

Recommendations:

1. That disposable syringes and needles be used for the bulk of intramuscular injections:

a. 2-cc. syringes with #24 needles or #25 hypodermic needles.

b. 2-cc. syringes with #21 or #20 intramuscular needles.

NURSING SERVICE: Cost Study—Disposable Syringes

Same areas, times, and same method of study used.

	7-3	3-11	Remarks
Total number injections:	218	140	
Average time—preparation	68.6 sec.	47.1 sec.	All preparations done in medicine room
—giving injection	90.2 sec.	73.3 sec.	
—disassembly	2.6 sec.	1.3 sec.	
Total	161.4 sec.	121.7 sec.	

Over-all totals:

Number injections	358	
Preparation	60.2 seconds per injection	
Giving	83.6 seconds per injection	
Disassembly	2.1 seconds per injection	
Total	145.9 seconds per injection	
Labor cost per injection on floor		$.084629
Cost of syringe unit		.15 each

Number of disposable units used March 5-30, 1958, compared with usage of reusable units during a comparable period in 1957:

Reusable syringes	5,040	This, of course, merely indicates a trend and will need further check. It suggests about 5 percent of prepared reusable syringes never used.
Disposable	4,800	
Decrease	240	

COMPARISON OF STUDIES—Reusable and Disposable Syringes—Unit

1 injection or 1 syringe and 1 needle

	Reusable	Disposable	Remarks
FLOORS			
Average time taken to prepare one injection	51.5 sec.	60.2 sec.	1. New procedure established preparation of dosage in medicine room rather than at bedside. Increased preparation time but decreased giving time.
Average time taken to give one injection	96.6 sec.	83.6 sec.	
Average time taken to disassemble one unit	13.2 sec.	2.1 sec.	
Total time for one injection	161.3 sec.	145.9 sec.	Better technic—better effect on patient.
Labor cost	$.0946831	$.084629	Total time and cost decreased.
CSR PROCESSING			
Collection	232.5 sec.	NONE	Processing costs eliminated with disposable units. With an average of 9,000 reusable units dispensed monthly this would amount to about 1,050 hours per month saving.
Sorting and cleaning	20.5 sec.		
Packaging	16.57 sec.		
Autoclave	21.8 sec.		
Distribution	130.0 sec.		
Total time	421.37 sec.		
Labor cost	$.19256609		
SUPPLIES			
Syringes and needles—cost per usage	.0144	.15	Increased cost of supplies with disposable units.
Other materials—(Cleaning and autoclaving supplies)	.02403		
Supplies cost	.03843	.15	
TOTAL COST	$.32567919	$.234629	Total saving approximately $.10 per injection.

Disposable Needles Meet Need for Sharpness, Sterility

By Randall B. Tinker* and Richard A. Hill**

● Utilization of the disposable hypodermic needle is already an accepted practice in many modern hospitals. Latest advancements in disposable needle technology indicate that the sterile, individual unit will soon be marketed. Cost estimates show that the time saved in central sterile supply areas alone will provide economic justification for its use.

High cost, of course, has been a major drawback to widespread use of disposable needles up to the present time.

The disposable needle provides the answer to two principal problems:

1. **Sharpness.** A needle should be so designed and constructed as to assure application of the parenteral medication at a desired site with a minimum of tissue trauma and aftereffect. Unfortunately, meticulous attention to the condition of the needle point is required to obtain these attributes.

Conventional needles—those which are reused—must undergo individual examination during processing in the hospital. Those which fail under observation, because of a burred or worn point, must be either discarded or resharpened. Frequent failures by personnel involved in checking this characteristic lead to increased tissue trauma and patient complaint.

2. **Sterility.** Medical literature is scattered with reports of cross-infection, injection abscess, and other conditions resulting from improper cleaning and resterilization of hypodermic needles. The difficulties encountered are inherent to the design of the needle itself.

Complete sterilization by any means depends upon the accessibility of the cleansing and sterilizing media to the surface being treated. The small lumen of the average hypodermic needle is one of the most difficult areas to reach in surgical sterilization. No guarantee of successful results has ever been anticipated; the situation has merely been tolerated, since no alternative existed. The high replacement cost of conventional needles precluded, in general, a single use followed by immediate destruction.

The element of disposability was first utilized by the military services in the early 1940's for single-dose units of morphine and of penicillin. These were not true disposable needles, but merely an adaptation of conventional needles. Their high cost could only be justified by the emergency situation then prevailing.

Production of a true disposable needle must be credited to Roehr Products Co., Inc., of Waterbury, Conn., and DeLand, Fla. Sensing the potential market for such a needle in disposable intravenous sets, the company undertook, in 1947, a program which led to the perfection of disposable needle design and manufacturing technics.

The needle was required to meet all existing specifications, yet be of such low cost that it would be expendable after one use. These requirements were met, and the needle was introduced on the market by Abbott Laboratories in their sterile blood and solution administration sets. The same needle, with only slight modification, is being supplied with almost every disposable parenteral set on today's market.

The introduction by pharmaceutical manufacturers of the disposable, prepackaged, single-dose unit (syringe, medicament, and needle) to the general trade required the inexpensive disposable needle. This need was likewise met, and the available range of sizes and gauges further increased.

It was not until early 1954, however, that the disposable needle was removed from the manufacturer's realm and introduced to hospitals and clinics for use in routine parenteral administration of medications. The needle gained immediate acceptance, since it provided an answer to the continual problems of sharpness and sterility. A new point at each use afforded a measure of protection against tissue trauma, and immediate disposal eliminated costly and inefficient cleansing procedures.

A means of affording patients maximum safety and comfort had been placed in the hands of every responsible hospital staff. That this could be done in an economical manner was a triumph of modern manufacturing technology.

Disposable hypodermic needles now appearing on the market are manufactured and distributed in the United States by Roehr Products Co., Inc., and Becton, Dickinson and Co. A Japanese-manufactured disposable needle finds outlet through Edco Surgical Supply Co., Inc.

Although the hubs of the disposable needles vary in alloy and design from the hub of the conventional hypodermic needle, the cannula tubing is of the same type alloy as that found in needles manufactured to federal specifications.

The needle is designed primarily for use with the slip-on syringe, but is also adaptable to Luer-type connections. The grinding and cutting processes and surface treatments produce a needle point that has been shown to be sharper than conventional needles in a new condition.[2]

Pharmaceutical manufacturers have found the needles to be of such cleanliness that no further processing is required prior to sterilization. The majority of hospitals, however, still include an ether or distilled water rinse before steam or dry-heat sterilization.

The convenience, ease of handling, economy, and safety[2] provided in this form of packaging will assure the disposable hypodermic needle greater prominence in routine clinical and hospital practice.

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Standard CSR Floor Carts Conserve Time, Energy

● Providing standard floor stocks of sterile supply items to each nursing unit conserves the personnel time of central sterile supply and of the nursing units.

Without a method for providing routinely the sterile supply items needed for a given period of time by the nursing units, much time is lost in central sterile supply because the work of the personnel is constantly interrupted to fill orders. The nursing staff work is also interrupted for making the requisitions and going to and from sterile supply.

Establishment of delivery standards decreases significantly the number of requisitions sent to central sterile supply daily. A stock standard reduces the sterile supply function to a clerical activity in the nursing unit, freeing personnel to perform bedside nursing. The necessity for day-to-day technical decisions for ordering can be eliminated. The head nurse still may exercise her technical discretion in ordering for unusual situations.

Where each nursing unit must prepare its own requisitions, it has been found that approximately 20 minutes per day are devoted by each unit to this preparation. An additional 25 minutes per nursing unit are spent by central sterile supply in processing the requisitions, and by the accounting unit in charging the cost to each nursing unit.

An average of 42 minutes per day is spent by personnel of each nursing unit going to and from sterile supply if there is no delivery service and supplemental or emergency requests must be made for supplies.

The standard sterile supply cart method permits all floor sterilizing to be done in sterile supply. A standard daily list of all items needed for sterilization is developed for each unit. A cart, kept on each nursing unit, contains all sterile items. This cart is picked up and restocked by central sterile supply, usually at night.

If this is done on the 11 p.m. to 7 a.m. shift in central sterile supply, advantage is taken of the period of lowest elevator use for pickup and delivery of carts to the floor.

The desirable by-products of this system are: standard quality of sterilization; elimination of detailed order-writing by nurses, processing by central sterile supply and charging by accounting, and curtailment of elevator travel to and from central supply during the day.

DEVELOPING FLOOR STANDARDS

Standards, whether developed for an inventory maintained on each nursing unit and filled periodically by central sterile supply, or for a cart or tray, may be developed according to the following steps:

(1) Analyze the amount of sterile items used in each nursing unit for approximately two months. In large hospitals, with a number of medical, surgical, obstetrical and other nursing units, the standard may be based on the experience of one nursing unit of each service (medicine, surgery, etc.). The accompanying chart presents a form used for this purpose. It lists only part of the items used by two general surgical nursing units.

(2) Determine for each item the number ordered each day by the nursing unit and the number returned after use.

(3) Determine those items ordered often, occasionally, and seldom.

(4) Discuss with the nursing personnel in each unit the items which they believe are necessary, although used only occasionally, to determine which should be included (a) on the standard tray, or (b) stocked on the floor for standby supplies.

(5) Develop separate standards for medicine, surgery, obstetrics, psychiatry, pediatrics, etc.

(6) After a standard has been tentatively agreed upon for each of the above areas, set up trays for a period of two weeks, and use a typical nursing unit in each of the above areas (medicine, surgery, etc.). Adjustments should be made in the final tray setup, depending upon the experiences of this trial run.

Each type of tray or cart should have a consistent layout for the actual location of items. For example, each medical tray should have all items in exactly the same location. This location should not change from day to day. This will simplify the loading of trays, checking for completeness, and locating of items by nursing personnel in the units.

Standards should be subjected to periodic review and modified in keeping with changes in patient load and medical requirements.

The use of standards will reduce considerably the accounting work performed by central sterile supply and by the accounting office. Each month, the nursing units can be charged a fixed amount. This will eliminate the pricing of all items and will greatly improve the control of inventory.

Simplification of the inventory control and elimination of the pricing of each order will permit the abolition of clerical positions often found in central sterile supply units.

THE SYSTEM IN ACTION

One hospital which is making effective use of a mobile cart central supply service is the U. S. Public Health Service Hospital in New Orleans.

Automatically, ward areas receive predetermined standard quantities of most specialized items required in nursing care.

The functionally designed carts, shown on these pages, are stocked in central supply to "realistic levels." Every day nursing assistants deliver newly stocked carts to nursing units and exchange them for the previous day's depleted carts.

The carts used are stainless steel dietary carts on which the hospital engineer made several revisions, including the addition of a special compart-

30 DAY RECORD OF STERILE SUPPLY ITEMS
–2 NURSING UNITS

CENTRAL STERILE SUPPLY

(Floor Supply - 2 Sample Units)

(29 Bed Pavilion Gen. Surg.) — APRIL

	W 1	T 2	F 3	S 4	S 5	M 6	T 7	W 8	T 9	F 10	S 11	S 12	M 13	T 14	W 15	T 16	F 17	S 18	S 19	M 20	T 21	W 22	T 23	F 24	S 25	S 26	M 27	T 28	W 29	T 30
Applicators			6					6					6								6			8				8		
Cord Dressings																														
Cotton Balls, Large		15	12			20	12	12		24			15	12			24			12	20	12	15		6		15	12		12
Cotton Balls, Medium																														
Fluffs																														
Fluffs 2x2 "Z"		12				12		6					12			12				12		15	6				20			
Fluffs 3x3 "Z"																														
Fluffs 4x4 "A.G."																														
Fluffs 4x4 "Z"																				1										
Fluffs 4x8 "Z"																														
Gauze Roll 2"							2																							
Gauze Roll 4-1/2"																														
Gloves, Size 6																														
Gloves, Size 6-1/2								6		6			6														6		6	4
Gloves, Size 7								3		6			6				3			6										
Gloves, Size 7-1/2								6	4				6				6			3							6			
Gloves, Size 8																														
Gloves, Size 8-1/2																														
Mastoid Dressings																														
Packing 1"Wide																														
Packing 1/2" Wide																														
Packing 1/4" Wide																														
Pads, Combination																														
Pads, Eye																														
Sheets, Circumcision																														
Sheets, Fenestrated																											6			
Spatulas			6					6					6																	
Tampons, Tonsil																														
Tooth Pick Swabs																											2			
Towels										1																				
Vaseline Gauze	1	1				1	1			1						1				1	1		1					1		
Vaseline Pack 1/4										1						3														
Unsterile Gloves																														
Unsterile Combination Pads (100)			2			3	3	2					3			2	1			2	1		1				3		1	
Drums, Cord Dressings																														
Drums, Cotton Balls					1	1		1														2						1	1	
Drums, Gauze 4x8																														
Drums, Pads, Perineal																														
Drums, Towels		1	1			3		2					3	1						3	1	1					2			
Surgical Dressings, Gauze 4x4													2							2										
Surgical Dressings, Gauze 4x8			1											1																
Surgical Dressings, Towels																														
Surgical Towels, Gauze 4x8																														
Urological Dressings	1	1	2			1	1	2	1	1			2			1					2						2	2	1	2
Sets, Bronchogram																														
Sets, Catheterization	2	4						1					1	2		2	3				5		2	2			2	2	1	4
Sets, Card Catheterization																														
Sets, Chest Suction									1																					
Sets, Cut Down		1								2								1			1									
Sets, Spinal Punc.																														
Sets, Stopcock, 3-way																		1							1					
Sets, Tracheotomy																														
Sets, Trach. Tube	1																													

(30 Bed Special Surgery Unit) — APRIL

	W 1	T 2	F 3	S 4	S 5	M 6	T 7	W 8	T 9	F 10	S 11	S 12	M 13	T 14	W 15	T 16	F 17	S 18	S 19	M 20	T 21	W 22	T 23	F 24	S 25	S 26	M 27	T 28	W 29	T 30
Applicators																								12						
Cord Dressings																								24						
Cotton Balls, Large		12	24				15	12	24			16				16			24		24		24						
Cotton Balls, Medium																														
Fluffs																														
Fluffs 2x2 "Z"							6	8								6														
Fluffs 3x3 "Z"							6																	6						
Fluffs 4x4 "A.G."		12	12				6	8																6						
Fluffs 4x4 "Z"			8					6												6				6			6			
Fluffs 4x8 "Z"																														
Gauze Roll 2"																														
Gauze Roll 4-1/2"																														
Gloves, Size 6																								2						
Gloves, Size 6-1/2		3						2				2				2			2		2			2						
Gloves, Size 7		3						2				2				2			2		2			2						
Gloves, Size 7-1/2		3						2				2				2			2		2			2						
Gloves, Size 8																														
Gloves, Size 8-1/2																														
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Sheets, Fenestrated																								2						
Spatulas																														
Tampons, Tonsil																														
Tooth Pick Swabs																														
Towels									1	1																				
Vaseline Gauze																														
Vaseline Pack 1/4																														
Unsterile Gloves																														
Unsterile Combination Pads (100)																														
Drums, Cord Dressings																														
Drums, Cotton Balls																														
Drums, Gauze 4x8																														
Drums, Pads, Perineal																														
Drums, Towels			2							2							1							2						
Surgical Dressings, Gauze 4x4																														
Surgical Dressings, Gauze 4x8																														
Surgical Dressings, Towels																														
Surgical Towels, Gauze 4x8																														
Urological Dressings																								4						
Sets, Bronchogram																														
Sets, Catheterization						4		2		3							2							4			6			
Sets, Card Catheterization																														
Sets, Chest Suction																														
Sets, Cut Down						1											2										1			
Sets, Spinal Punc.																											1			
Sets, Stopcock, 3-way																														
Sets, Tracheotomy																														
Sets, Trach. Tube																														

mented section at the top for holding small items.

Hospital personnel rate it highly because it:

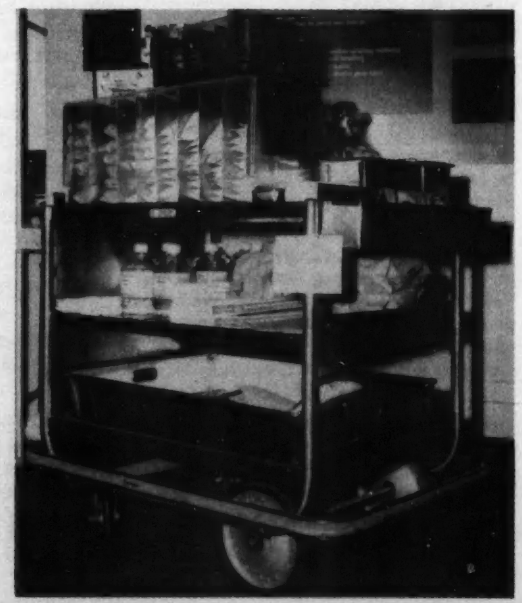
(1) Improves patient care—by assuring readily accessible and sufficient nursing supplies, by making nurses' time available for professional duties, and by making it possible, in an emergency, to place supplies at the bedside.

(2) Facilitates efficient administration—by stopping hoarding, by keeping sterile supplies in circulation, therefore curtailing outdating; by increasing work space in nursing units, by improving utilization of nursing personnel, and by saving time.

The following supplies are stocked in the cart:

1 G.U. rack
1 G.U. bottle
1 single drain
1 ice cap
6 5% dextrose in D/W
3 5% dextrose in N/S
1 enema can
10 rectal tubes
1 bag rectal gloves size 8
12 bed pads
3 cans fluffs
3 cans ABD pads
2 wet dressing sets
2 catheter irrigation sets
1 flask normal saline, 2000 cc.
1 flask distilled water, 2000 cc.
2 catheterization trays
1 catheter, 16 fr.
1 catheter, 18 fr.
1 pair sterile gloves, 7½
1 pair sterile gloves, 8
2 lavage trays
1 hypo Mizur
1 I.M. Mizur
3 suspensories, extra large
8 G.U. syringes
10 50 cc. syringes
10 30 cc. syringes
10 20 cc. syringes
12 10 cc. syringes
12 5 cc. syringes
15 insulin syringes
15 tuberculin syringes
15 needles, 26 gauge
15 needles, 25 gauge
15 needles, 24 gauge
15 needles, 22 gauge
15 needles, 20 gauge
15 needles, 18 gauge
1 package 2 x 2 sponges
1 adhesive tape ½"
1 gauze bandage 2"
1 gauze bandage 1"
4 denture cups
2 bags tongue blades
3 plastic Levin tubes
3 5-yd. rolls, sterile
2 blood sets, R-48
4 Safti-sets, 800-15

Views of floor cart developed at the U.S. Public Health Service Hospital, New Orleans, are shown at left and below.



Those responsible for its development were Mrs. Mary E. Damian, R.N., director of nursing; Agnes Hinger, R.N., operating room and central supply supervisor; Beulah Cantrell, R.N., head nurse in central supply; Richard Pharis, supply officer, and Arthur Klette, building superintendent.

Project had encouragement and support of medical officer in charge, John N. Bowden, M.D., and administrative officer Paul Burke.

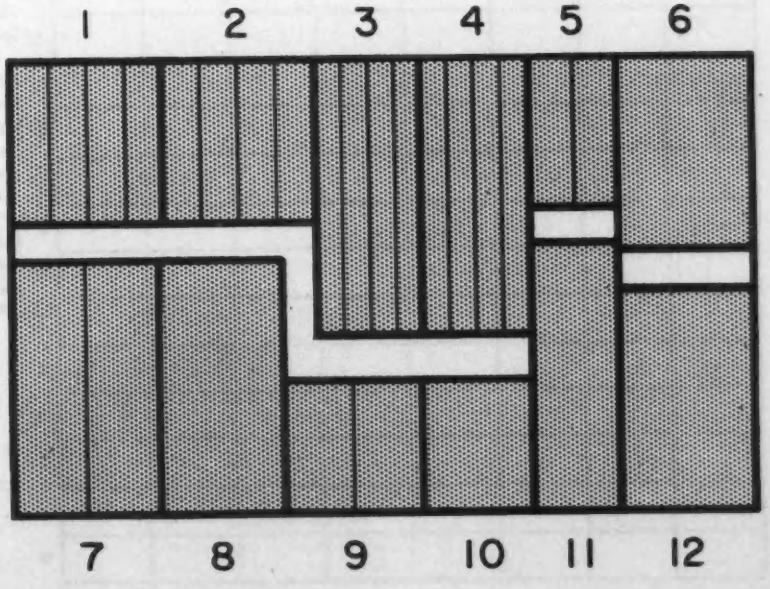
Hospital-Designed Delivery Cart

The central service supply cart shown here was designed to provide pick-up and delivery service for the floors in the 100-bed Champlain Valley Hospital, Plattsburg, N.Y.

The cart makes two trips daily—at 8:30 a.m. and 1 p.m. Syringes, needles, thermometers, catheterization and douche trays, hot-pack trays, dressings, and intravenous solutions and sets are left on the floors in standard amounts.

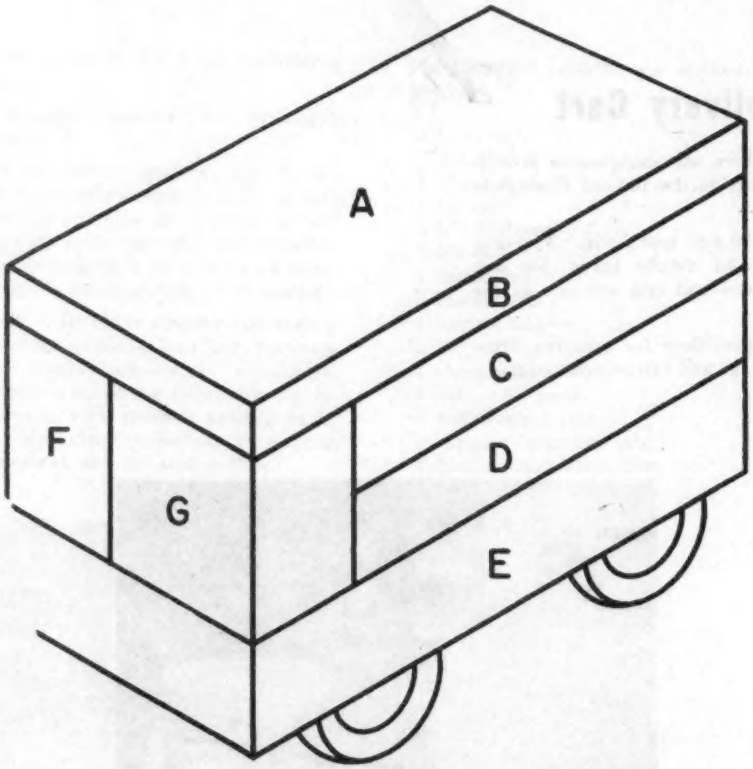
White charge slips are available on each floor for ordering extra supplies. They are used to charge dressings and intravenous solutions used by each patient.

The cart was built by the hospital's carpenter, at an estimated cost of $155. The drawings and pictures were sent in by Sister St. Marie, who says that the cart conserves time of floor personnel and central service staff and gives the department better control of supplies used.



At right is a diagram showing the 12 drawers (Section B of cart). Dimensions are:

Nos. 1 and 2—length, 6"; width, 8½"-height, 4"
Nos. 3 and 4—18" x 8¼" x 4"
No. 5—8" x 3½" x 4"
No. 6—12" x 9" x 4"
Nos. 7 and 8—18" x 8½" x 4"
No. 9—8" x 8¼" x 4"
No. 10—8" x 8" x 4"
No. 11—18" x 3½" x 4"
No. 12—14" x 3½" x 20"



Scale: 1" - 16". Length—53"; width—29½"; height—43".

A. TOP SHELF:
24 2cc. syringes; 2 5cc. syringes; 1 tray—2 10cc. syringes and 1 boat of syringe cleaner; 1 20cc. syringe, 2 insulin syringes

B. DRAWERS:
Nos. 1 and 2, needles; 3 and 4, catheters; 5, applicators, tongue blades; 6, sterile gloves; 7, sterile towels, suture sets, fluff gauze; 8, combine pads; 9, bandage, sterile medicine glasses; 10, adhesive tape; 11, soap; 12, large sterile dressings

C. SECOND SHELF:
Sponges—boxes of 24; unsterile supplies—like safety pins, etc.; sterile bulb syringes

D. THIRD SHELF:
Douche and catheter trays

E. FOURTH SHELF:
Intravenous solutions and sets; sterile cottonball cans; flasks of sterile normal saline and sterile water; bags for wrappers

F. 20" DEEP DRAWER:
Large sterile dressings

G. SHELF IN FRONT OF DEEP DRAWER:
Alcohol, drinking tubes, Mercressin, tincture of Benzoin

CSR Assumes Distribution Of Numerous Unsterile Items

By Ruth L. Rochford, R.N.*

● Every effort should be made to achieve optimum use of a central service department. To attain this goal at the Rhode Island Hospital, plans were formulated to provide for the distribution by central service department personnel of a number of unsterile items, according to pre-established pars.

Prior to the opening of our new 10-story, modernly equipped building (into which patients were transferred December 28, 1955), a committee met to evaluate the items routinely ordered by nursing units from stores and central services.

Members of that committee were the associate director of nursing service, the manager of the stores department, the executive housekeeper, an assistant administrator of the hospital, a nursing supervisor, a head nurse, a staff nurse, and the director of central services.

According to plans which had been previously formulated, such items as needles, syringes, and instruments, as well as items for patients' personal care, such as bedpans, emesis basins, and wash basins, were to be distributed by central service, sterile and packaged individually or as a complete unit.

*Director, central services, Rhode Island Hospital, Providence.

Requisition Sheet Completed by Central Service Personnel Nightly

DATE:_____

		PRN	4A	4B	5A	5B	6A	6B	7A	TOTAL
M-80-2	battery, otoscope	2								
M-80-3	battery, flashlight	2								
M-91	bottle, hot water	2								
M-103	box, stool specimen	10								
M-677	spoon, specimen	10								
M-205-B	clamps, Hoffman	12								
M-262	depressors, tongue	50								
M-315	gloves, rectal	10								
M-410-A	flashlight lamp	2								
M-829	tourniquet—36"	3								
M-988-1	bandage, gauze, 1"	3								
M-988-2	bandage, gauze, 2"	3								
M-988-3	bandage, gauze, 3"	3								
M-988-4	bandage, gauze, 4"	2								
M-1175-½	adhesive tape, ½"	3								
M-1175-1	adhesive tape, 1"	4								
M-1175-1½	adhesive tape, 1½"	3								
M-1175-3	adhesive tape, 3"	3								
M-84	razor blades	5								

It was felt that further consideration should be given to eliminating, insofar as was practical, the need for the nurse on the unit to write requisitions for other items.

The storekeeper provided records of items commonly ordered by nursing units, such as adhesive tape, hot-water bottles, stethoscopes, soap, cleaning powder, requisition forms, pencils, and paper cups.

The executive housekeeper explained the type of housekeeping service that her department planned to render. As a part of that service, items such as cleaning powder, soap, and paper towels would be routinely supplied by her department according to the size of the unit.

The storekeeper accepted the responsibility of routinely providing desk supplies and some other items, such as Wipettes and Flex-Straws, either once or twice a week. The remainder of the items, such as adhesive tape, bandages, screw clamps, specimen boxes and spoons, razor blades, and rectal gloves, were to be the responsibility of the central service department.

Each unit was planned to admit a specific type of patient (surgical, medical, or orthopedic, for instance), and from available statistics, a comparatively accurate daily census of each type of admission was obtained. Figures were then tabulated for the maximum number of each item needed to carry out proper care of patients for a 24-hour period.

NIGHT PERSONNEL DISTRIBUTE

Night personnel in the central service department, whose hours on duty are 12 midnight to 8 a.m., are responsible for the distribution of items to nursing units, immediately after their arrival on duty.

Because of the vertical construction of our hospital, each utility and dressing room is exactly the same and in the same area on each floor. Drawers, closets, and sections within drawers in these rooms are clearly marked to indicate spaces for the supplying departments.

A small, stainless-steel, tiered, wheeled truck is loaded in the central service department and taken to each unit. Personnel making the deliveries start on the tenth (the top) floor and work downward.

The midnight hour was chosen for this task because of less use of elevators at this time, less activity on the units, and less use of the areas into which supplies would be placed.

Supplier, Location, and Standards of Supplies Regularly Used by Nursing Units in the New Building

KEYS TO FORM SHOWN BELOW

SUPPLIER

CS: Central Services
St: Stores
H: Housekeeping

LOCATION

U: Utility room
MR: Medicine room (drawers labeled)
LR: Linen room

HN: Head nurse
SgC: Surgical cart
D: Drawer
S: Shelf
a-h: inclusive, small letters: section of drawer

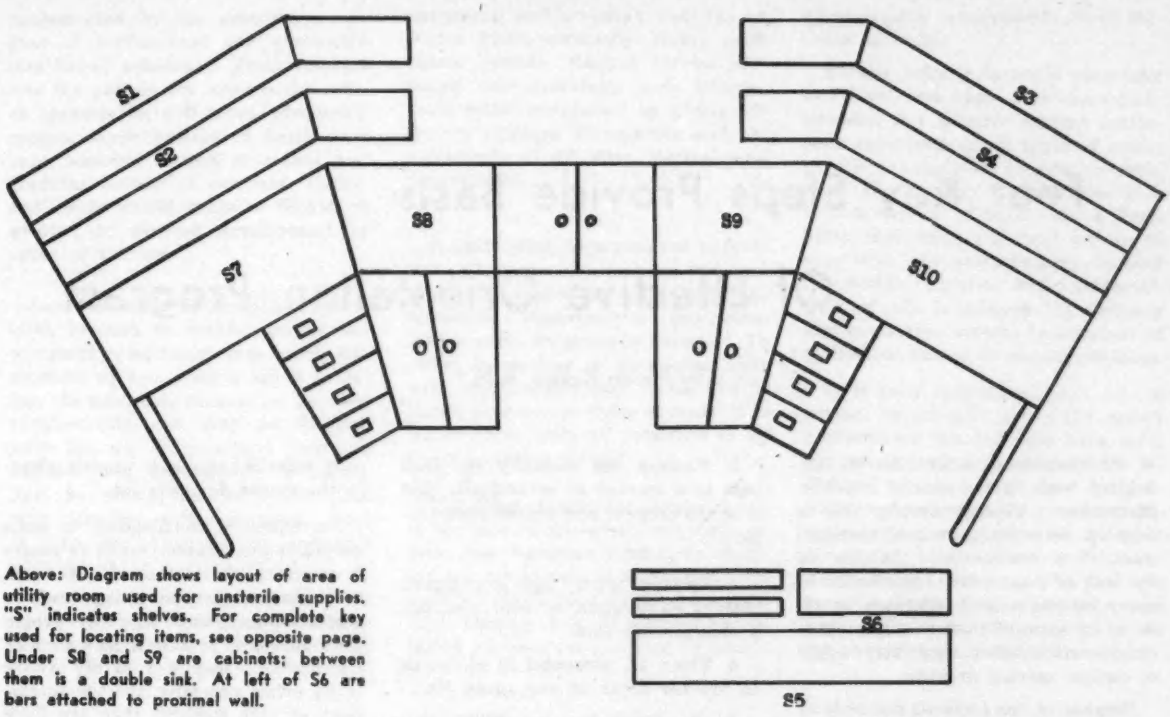
(Example: U-D5-g: located in g section, drawer No. 5 of utility room)

SHELF STANDARDS

D: Stored on unit; requisitioned daily up to standard by supplying department
W: Stored on unit; requisitioned weekly up to standard by supplying department
PRN: Small amount kept on unit; requisitioned up to standard by supplying department when nearly used up
N: None stored on unit; requested by telephone from supplying department as needed
T: Supplied in sterile trays or sets
C: Item for which patient is charged
RR: New items supplied only when old ones returned

Special Standards: Unit, Medical Service, and No. of Beds

Item	Supplier	Location	General Shelf Standard	Unit	Stock No.	4A NS 35	4B SpC 28	5A GS 39	5B GS 37	6 C 2
Adapter - BD470C	CS		T	ea	M-50-B					
Adapter-Hypo Syringe	CS		N	ea	M-50					
Applicator-Cotton-Tip--3"-100	CS		N	bag	M-55-3					
Applicator-Cotton-Tip--6"-100	CS	U-D5-d	Prn 100	bag	M-55-6					
Bag-Ice-Throat-9"	CS		N	ea	M-68					
Bag-Paper-No. 6	St	U-D3-b	W100	ea	H-750-6					
Bag-Clothes-Adult	St	U-D4	W25	ea	H-753-A					
Bag-Wax Lined	St	U-D3-b	W15	ea	H-759					
Bandage-Adhesive-Ace-3"	CS		N-C	ea	M-980-3					
Bandage-Adhesive-Ace-4"	CS		N-C	ea	M-980-4					
Bandage-Adhesive-Elastoplast-3"	CS		N	ea	M-984-3					
Bandage-Adhesive-Elastoplast-4"	CS		N	ea	M-984-4					
Bandage-Cotton-Elastic-Superward-2"	CS		N-C	ea	M-986-2					
Bandage-Cotton-Elastic-Superward-3"	CS		N-C	ea	M-986-3					
Bandage-Cotton-Elastic-Superward-4"	CS		N-C	ea	M-986-4					
Bandage-Gauze-1"	CS	U-D5-e	D3	ea	M-988-1					
Bandage-Gauze-2"	CS	U-D5-e	D3	ea	M-988-2					
Bandage-Gauze-3"	CS	U-D5-e	D3	ea	M-988-3					
Bandage-Gauze-4"	CS	U-D5-e	D2	ea	M-988-4					
Bandage-Muslin-4"	CS		N	ea	M-992-4					
Band-aid--1" x 3"	CS		N	ea	M-970					
Basin-Pus (Emesis) Kidney Shaped--10" x 2"-Steel	CS	U-S4	D6	ea	M-1300					
Basin-Wash-13" Dia.-3½" Deep-Steel	CS		N	ea	M-1305					
Battery-Otoscope	CS	U-D5-g	(D2)(RR)	ea	M-80-2					
Battery-Flashlight	CS	U-D5-g	(D2)(RR)	ea	M-80-3					
Blade-Razor-Double Edge-5/pkg.	CS		T	pkg.	M-84					
Blade-Surgical-BP #10-6/pkg.	CS		T	pkg.	M-1725-10					



Above: Diagram shows layout of area of utility room used for unsterile supplies. "S" indicates shelves. For complete key used for locating items, see opposite page. Under S8 and S9 are cabinets; between them is a double sink. At left of S6 are bars attached to proximal wall.

Furthermore, because of the construction of our building, it is unnecessary to invade the actual patient area.

From the original committee that planned for this system of distribution has evolved a committee on unsterile supplies, composed of eight people:

(1) Administrative assistant (chairman)
(2) Director of central services
(3) Executive housekeeper
(4) Manager, stores department
(5) One clinical supervisor
(6) Two head nurses
(7) One staff nurse
(8) Assistant from central service department.

This committee meets monthly. Its function is to establish and improve a system for the distribution of nonsterile supplies, in order to contribute to a high quality of patient care, by:

- Establishing standards of items to be available in the units and periodically reviewing and changing these standards in response to the units' needs.
- Resolving problems between the suppliers and users of stock items, particularly in the area of distribution.
- Exchanging information between users and suppliers within the hospital to create an atmosphere of understanding and co-operation between these two basic groups.

After nearly two years of this program, definite economy measures have been evident in many areas. Therefore, the committee has selected, as a project for the coming year, "Economy in Use of Supplies."

Posters and various objects will be placed in strategic areas and changed from time to time, so that not only our hospital personnel, but also visitors may be made aware of the continuing high costs to the hospital of much of its supplies. We hope that this project will be educational and enlightening to all concerned.

Four Key Steps Provide Basis Of Effective Orientation Program

By Helen Rakov, R.N.*

● Prerequisite to orientation in any field of work is the careful selection of workers. Though usually this is capably done by personnel management, it is recommended, in view of the lack of a personnel department in many hospitals, that attention be focused on some of the many important considerations that singularly apply to central service workers.

Because of the physical demands of the varied tasks, it is not only necessary that trainees be of good character and morally reliable, but that they be screened to eliminate those having any physical deficiencies that may hamper job performance.

A few of these are: dermatitis, which may be aggravated by use of detergents and work in the wet area; shortness in stature, which may prevent able and comfortable reaching, piling, and stacking of packs; frailness in health and physique, which may in short time make the daily lifting tasks unendurable; and excessive weight or leg and foot conditions, which could make lengthy periods of standing painfully unbearable.

Marked attention to these and other seemingly small details can lessen costly, forced turnover in personnel, disruption of assignment schedules, and retardation of work flow.

When qualified personnel have been obtained, a program designed to achieve orientation can be initiated. A brief definition of the aim of orientation is to prepare and train one to perform the total job ably and efficiently. To aid in achieving this goal, the following key suggestions are offered:

1. Fashion an attitude of enthusiasm and respect for central service and its work.

2. Explain the necessity for each task in a manner so enthusiastic that it spurs diligent and conscientious effort.

3. Develop intra- and interdepartmental cooperation to help maintain a steady work flow.

4. Train all personnel in all tasks, to provide depth at any given job.

1. To avoid the possibility that workers may view central service tasks as menial and lacking in dignity, it is advisable to fashion an attitude of respect and enthusiasm for the department and its work. Though many ideas and methods may be employed in seeking to reach this goal, a most essential one is to explain fully and stress the high place of central service in present-day hospital organization, particularly its function as a supply line to every station, department, and attending doctor, and, more dramatically, as a lifeline to every patient.

The means of effectively communicating this point may vary from likening central service to a huge octopus whose many arms reach out into every room, station, and department through the processed needle, syringe, tray, and pack, to giving employees an actual tour of the hospital and pointing out the great importance of the work of central service.

With an initial understanding of the far-reaching scope and urgent necessity for such work, possible preconceived notions of the lowliness of the tasks are overcome, and the central-service job becomes one of dignity that sparks enthusiasm.

2. It is obvious from the very nature of central service that its tasks must be discharged with diligence and conscientiousness. Though there may be many ways to attain these ends, a very effective one is to explain clearly the reason for each job.

For example, sterilization, to some people, is just another word; to others it suggests physical operations such as boiling water and using heat or pressurizing steam. Few lay people know the basic principles and aims of sterilization; they are hardly aware of its prime necessity and the limitations of each method; they are little informed about the danger of lack of sterilization and its possible serious consequences.

However, after they hear explanations of sterilization and proper use of its various methods, of the danger of rapidly multiplying bacteria and spore formation and the urgency of utter destruction of these organisms, conscience becomes an invisible but effective spur to diligence.

To further induce conscientious and diligent work, tasks might be translated into terms of human comfort and discomfort. The tendency of workers to view their tasks as always being beneficial is good, providing the work is well done.

Why not make them aware of the discomfort occasioned by a poorly sharpened needle, the anxiety caused by an inoperative piece of equipment, or the infection and possible death resulting from lack of sterilization? By stressing these possibilities we help evolve within each worker a constant prod — conscience — the super-supervisor.

3. The principal function of central service is to supply all stations and departments with adequate amounts of properly processed supplies and equipment. This can best be assured by developing intra- and interdepartmental cooperation so that an unhampered flow of work prevails.

The intradepartmental phase can be

*Central service supervisor, Abbott Hospital, Minneapolis.

implemented by the exemplary conduct of professional and previously established personnel. Their example sets the pattern for what is desirable or undesirable: soft tones, pleasantly spoken words instead of harsh loud ones, requests instead of orders, and kindness instead of curtness. Gossip and controversial subjects should be avoided to prevent development of areas of friction.

Interdepartmental cooperation is vital, because no central service department is sufficient unto itself. Regardless of how good a job it is doing, its total job, because of its very requirements, can only be fulfilled with the aid of personnel from all stations and departments it serves. Just as central service feeds these with supplies and equipment, they, in turn, feed back utensils, reusable supplies, trays, and equipment.

Cooperating departments reduce the central service work load by careful, less wasteful use of supplies and equipment and prompt return of scarce items, especially during peak census periods. Central service personnel can encourage such interdepartmental cooperation by giving attentive response to requests and requirements of all other stations and departments.

4. Quite often, as a result of unforeseen circumstances, such as personal problems, illness, or inexcusable absenteeism, departmental production may become dangerously curtailed. To offset the inroad on production that such eventualities may create and to lessen pressure on those at work, it is advisable to train all personnel in all central service tasks.

This practice provides greater depth in workers at any given task and enables the department head, by shifting jobs, to process in ample quantity, supplies about to become exhausted. Such training may be realized by rotating all work regularly or by scheduling weekly assignments that embrace all tasks.

Besides helping to avoid monotony and disinterest which may cause carelessness, this practice assures continuous experience in all types of work; greater productivity, because no worker is idle because of expertness in a limited number of tasks; and a flexibility that enables central service to cope with any extraordinary demand for certain supplies and equipment. Best of all, it bolsters the primary aim to prevent serious impairment of production caused by shorthandedness.

It is fully appreciated that central service orientation presents many problems not touched upon here, some general and others peculiar to the individual hospital. The four suggestions made above have general application and are submitted in the spirit of sharing observations and conclusions derived from practice and experience, in the hope that they may prove helpful to those interested in central service orientation.

Visual Aids Reduce Instruction Period, Save Time on Floors

By Edith B. Marshall, R.N.*

● To maintain the necessary high efficiency in the central supply room—a vital department in the hospital—we at the Elizabeth (N.J.) General Hospital have developed the use of visual aids for the teaching of all personnel, including registered and practical nurses, professional and practical nursing students, aides, and volunteers who work in this department.

We are using a loose-leaf notebook containing instruction sheets and photographs (see accompanying illustrations for examples).

The Hospital Pictures Service, Red Bank, N.J., which takes our baby pictures, also took the pictures for our central supply procedure book. We have found that the use of visual aids, plus the printed lists of articles needed for each procedure, has reduced the amount of instruction time needed for each member of the central supply room staff.

Central-supply personnel assemble all trays by referring to the lists in their procedure books and the appropriate photographs. In this way the person making up the tray can check the completed tray with both list and picture and see immediately whether there are any omissions or duplications.

We have an active procedure committee, consisting of a faculty member from the school of nursing, an assistant director from nursing service, a head nurse, a general staff nurse, and a student professional nurse. The committee meets each month to discuss procedures and suggested amendments.

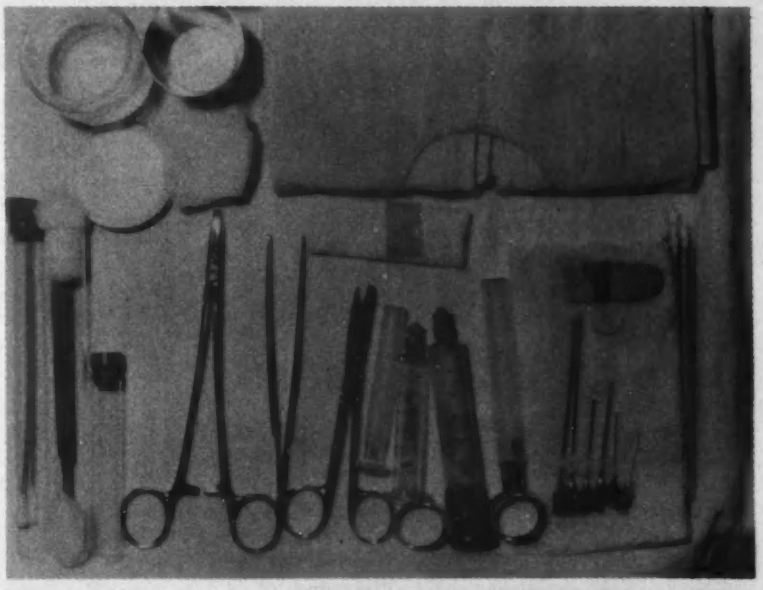
Every three months at the head nurses' meeting, a list of breakages and losses, with cost, is given to each head nurse. This list is compiled by central supply and is posted on the bulletin board of each floor, thus enabling the head nurse of each department to compare her loss and breakage with those of the other floors. This list is an incentive to reduce the losses and breakages for the next three months.

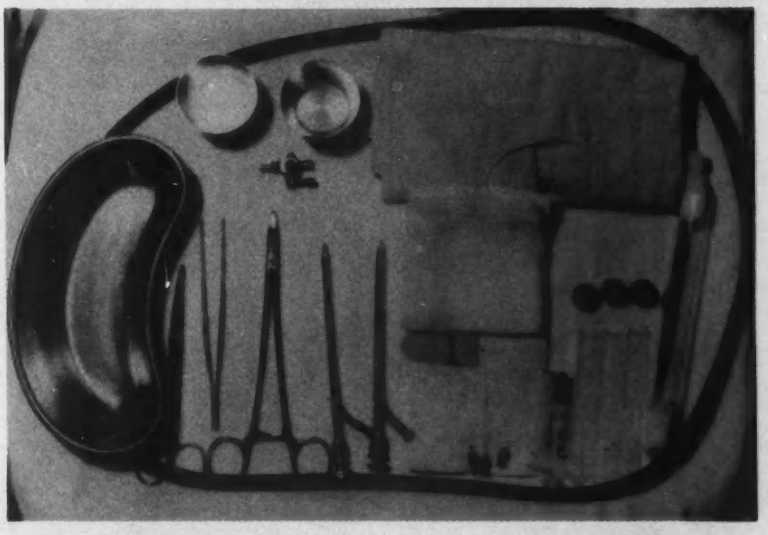
The international sales department of Becton, Dickinson and Co., Rutherford, N.J., uses our central supply department for educational purposes. Before going into the foreign fields, representatives of this firm spend from several days to a week in this department learning all the procedures. This on-the-job observation has been valuable not only to these representatives but to us, for we have been given some new and better ideas on how to improve our services.

We have found that the use of visual aids in central supply has saved hours of work for our supervisor, Mrs. Theresa Mulligan, R.N. The personnel, by using the procedure book and photographs, are able to distinguish the various types of instruments and other items without constant reference to the supervisor. Then too, personnel learn the names of the different instruments more readily by comparing them with the photographs and printed lists.

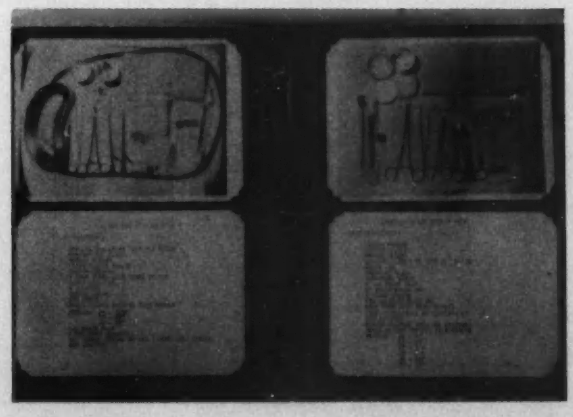
Moreover, as all the trays are assembled in the same manner (i.e., by the use of the procedure book), there is less confusion on the floors for the doctors and nurses using the trays. They now know exactly where to find the equipment on each set-up. In view of the frequency of staff turnover, the consequent saving is important.

*Director of nursing service, Elizabeth (N. J.) General Hospital and Dispensary.





Above, top: Photograph of tray assembled with aspiration biopsy set, plus printed list of articles needed provides efficient guide for central supply staff. Above, second: Photograph showing paracentesis set. Right: Sample breakage list, similar to those distributed to each department's head nurse. Below: Looseleaf notebook, each page enclosed in transparent protective envelope.



MEMORANDUM TO: MALE SURGICAL

The following is a list of the breakage and loss in your department for items sent to you from central supply for period beginning April, May, and June, 1956:

	Quan.	*Item*	*Each*	*Extended*
BREAKAGE:	2	2cc. syringes	$2.25	$4.50
	7	5cc. syringes	3.00	21.00
	1	30cc. syringe	5.20	5.20
	1	2oz. Asepto	1.73	1.73
	3	1oz. Asepto	1.55	4.65
LOSS:	3	Instrument sets	23.61	70.83
	23	2cc. syringes	2.25	51.75
	35	5cc. syringes	3.00	105.00
	6	Insulin	2.25	13.50
	1	Kelly	4.81	4.81
		TOTAL		$282.97

Signed.....

Director

Orientation Program Acquaints Nurses With CSR Functions

● A common problem of central supply supervisors is that the floors do not know what services the department offers, CSR supervisors at the recent Tri-State Hospital Assembly agreed. As a result, floor personnel may make unreasonable demands—or may fail to make effective use of standard services that are available.

Good interdepartmental communication is one answer to this problem. Another is a well-organized orientation program—to acquaint all new nursing personnel with central supply functions.

The orientation program for new graduate nurses at Weiss Memorial Hospital, Chicago, includes two hours in the central supply department—preferably in the afternoon, when the department is really buzzing, according to Mrs. Blanche Jorgensen, supervisor.

Gloves are stored in the oxygen therapy department in discarded disposable oxygen tents. The tents are first cleaned with alcohol and Zephiran. Then the sewing department stitches up the bag. Previously each bag for gloves was taped together and the whole pack had to be taken down to find the correct size gloves. Sometimes the tape would fall off and there would be no identification. Mrs. Blanche Jorgensen, R.N., central supply supervisor, is shown with the glove bags.

On their tour, nurses receive a summary of the articles kept in the department. Then when they get back to the floors they can recheck their floor lists. They are told how central supply wants them to order and return supplies and equipment. They learn about the functions of the Weiss central supply department—which are:

● Inspecting, folding, and sterilizing all operating-room packs.

● Sterilizing all instruments and solutions.

● Sterilizing and packaging all disposable needles, and washing, sterilizing and packaging all syringes.

● Washing, drying, sterilizing, and supplying all gloves for all departments.

● Preparing and sterilizing all sterile supplies and trays for floors.

● Preparing all sterile and distilled water for the entire hospital, including the pharmacy and the laboratory.

● Preparing all sterile supplies for the diagnostic clinic and the emergency room.

● Preparing sterile equipment for x-ray—such as myelogram, patency, and intravenous pyelography trays.

● Sterilizing enema equipment. All bedpans and urinals are supplied on an exchange basis, and are wrapped and resterilized for the next patient.

● Dispensing prewrapped Vaseline by requisition.

● Taking care of all IV solutions.

● Storing and distributing all inhalation therapy equipment and making sure that it is in good working order.

● Supplying suction machines and checking to see that they are in good repair.

● Picking up and delivering supplies. A girl makes deliveries to the floors every half hour and picks up the requisition when she makes the delivery.

● Keeping a daily list of all items outstanding on the floors.

● About one-half of the nurses' orientation period is spent in oxygen therapy. They learn the care and use of the machines, and how to order and insert the flowmeters. There are two types of wall adapters that go to different floors. Nurses have to learn which floors utilize the old adapters and which use the new ones.

In the future Mrs. Jorgensen hopes to extend the orientation period to three days for central supply. Then she plans to include instruction in what central supply expects of a floor nurse, and additional information on equipment.

UTILIZATION OF AIDES

Like most hospitals these days, Weiss Memorial employs a large number of aides. Aides get about a half-hour tour of the department, so that they know where it is and have a general idea of its purpose.

The aides employed in the department itself get on-the-job training. The department is explained by a senior aide. A new aide will ask questions more frequently when dealing with a person on her own level, Mrs. Jorgensen points out.

First the aide learns the folding of linen; then she moves to the cleaning of syringes. At the end of the first week she is taught how to put up special trays.

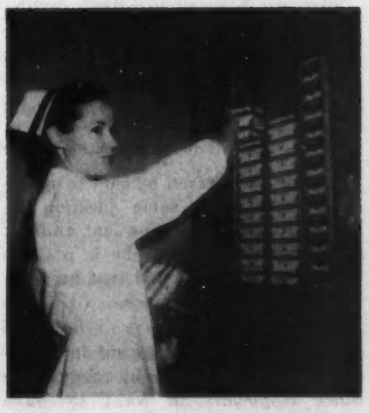
During the second week the aide goes with the girl on the syringe cart and learns how to give even exchanges. At the end of the third week she can make surgical linen packs by herself. The fourth week includes glove procedure routine and experience in the pick-up and delivery service. In the fifth week she services the floors with dressing carts. In the sixth week the aide learns about the filling and sterilizing of distilled water flasks for surgery.

There are nine aides in the department. One has been there four years and is considered the senior aide. Another has been there for three years, and another for two. The remainder are relatively new.

Left: Mrs. Jorgensen supervises the cleaning of syringes by new personnel, Vera Shelly and Velma Fraizer, aides.

Above: Ola Mae Whitt, aide, checks the procedure manual on making linen packs for surgery. Every procedure is pictured in the book.

Below: This IV tubing dispenser was designed by John French, Jr., former CSR supervisor, and Mrs. Jorgensen. Two channels are reserved for Venopaks, one for secondary Venopaks, and one for secondary blood sets. All articles in the department are listed on the outside of the cabinet. Anything that is in a cabinet is preceded by a "C." A "D" denotes a drawer, and an "S," a shelf.



Right: Boxes are not discarded. They are used to help keep the cabinets clean, and for identification purposes. Theo McCarary, aide, is putting a new pack away.

What Student Nurses Gain From CSR Experience

By Betsey R. Carroll, R.N.*

The curriculum committee at the University of Kansas Medical Center discussed for many days the possibility of placing nursing students in central supply. The question that always came up was "Where can we find the time?" But at last they made time, although it was only for a few short hours.

Because of the time limit, the program needed to be concentrated, with emphasis on basic principles of aseptic technic. These basic principles were first given to the students in a series of lectures, followed by five hours of practical experience in the department. Through individual conversation a great deal of additional knowledge was given to the students as they practiced the technics.

Forty-three students took the concentrated program. Each student was asked to write an article after her experience in the department. The following papers were written by four "foundation nursing students" ("probies").

We felt that others in the central service field might be interested in the student's viewpoint of central service in relation to the hospital and her nursing career.

The general topics discussed include:

(1) Improving patient care through intelligent use of supplies.

(2) Assisting in hospital economy.

(3) Teaching others the correct technics and care of equipment.

(4) Assisting with communication and interdepartmental human relationships.

By Dorothy Johnson

● In any hospital, the patient is the most important consideration. This fact should be foremost in the mind of each individual who is caring for him. Every member of the hospital personnel is directly or indirectly responsible for each patient. Therefore, unless this fact is realized by each and unless all work as a team to give the best care possible, the patient will undoubtedly suffer.

Moreover, every patient who enters the hospital will be a consumer of supplies, whether he is hospitalized for a day or for two or three weeks. Obviously, intelligent usage of supplies is of vital importance.

The student nurse *can* help to improve patient care through intelligent usage of supplies, but to do so, she must be conscientious and must use good judgment. In addition, she must be completely honest with herself. She should avoid contamination of supplies which must be kept sterile, but should she contaminate them or suspect contamination, she must realize the necessity for exchanging the contaminated article for a sterile one.

The student trying to place herself in the position of the patient would impress upon herself the necessity of intelligent usage of supplies.

By using supplies sparingly and by avoiding waste, the student can help prevent exhaustion of supplies in case of an emergency.

Finally, she can minimize many discomforts for the patient, such as burns, cuts, and broken needles, and awkwardness in handling supplies, if she understands thoroughly the uses, dangers, and mechanics of all supplies.

There are many ways in which the student nurse can improve hospital economy by intelligent usage of supplies. A few of these are:

(1) Using all supplies as if she were paying for them herself,

(2) Handling supplies with care—avoiding breakage, spilling, and measuring out more solutions than necessary, which results in waste; guarding against allowing rubber and plastic articles to become overheated, rendering them unusable; avoiding throwing away articles that could be reused; and avoiding contamination through carelessness,

(3) Ordering no more supplies from central service than are needed,

(4) Using supplies before "effective sterilization date" has expired.

In teaching others the correct technics and care of equipment used, the student must first know the correct technics and care of equipment used and *practice her knowledge;* otherwise, her teaching will be ineffective. Secondly, when she observes someone using incorrect methods in using and caring for equipment, she should very tactfully explain why the method used was unwise and demonstrate the *correct method.* Thirdly, she should show a real interest in questions or advice asked of her concerning usage or care of equipment.

She should take particular care in answering in a manner in which the questioner can understand. If she is not sure of the correct answer, she should ask someone who knows and then explain it.

Should this person be slow to understand or ask the same question repeatedly, she must be patient and not drop the matter until she is positive that he understands and that he practices the proper technics.

The student can also aid in teaching correct procedures by stimulating other employees to want to learn more about their work so that they will have a thorough knowledge of their jobs and a desire to learn facts. This she can do by her own enthusiasm.

*Mrs. Carroll is administrative supervisor, central service department, University of Kansas Medical Center, Kansas City, Kan.

Good human relationships and communications between nursing units and central service are very important in the efficiency of both departments. Courses exercised by these departments will aid a great deal in promoting both better human relationships and communication.

Desirable human relationships are never present when there is the feeling that this or that job is of no importance. There is no job in the hospital that is not important. Realization of this fact will certainly aid in better human relationships.

Nursing units could improve communications by making sure the syringes and other instruments are properly rinsed and in the proper container at the proper time, so that central service can make its pick-ups rapidly and efficiently. This practice will also aid central service in maintaining a speedy assembly.

By the same token, central service can help the nursing units by filling requisitions promptly and correctly and by checking the supplies for defects before arriving on the nursing unit with them.

By Janet Hanneman

● Our prime purpose as student nurses is to learn to give total patient care in the most efficient manner possible. We may have the best in equipment and supplies at our disposal and yet give poor patient care through unintelligent usage.

While we are students we should learn the correct technics in handling supplies, both sterile and unsterile. Maintaining aseptic technic in using sterile supplies is of the utmost importance in promoting healing and preventing the spread of infection. Student nurses, as well as the rest of the nursing team, should use dexterity in handling sterile supplies, but we should not hesitate to start over again with new supplies, if they have used faulty technic in a procedure.

Many times we will be the only ones who know we have contaminated our needles, syringes, sponges, etc. Even though we may use twice as many supplies as we should, it is better to complete a procedure that was supposed to be sterile knowing that aseptic technic was maintained.

As student nurses we can do our part in maintaining adequate supplies on the floor. Delays in giving treatments while waiting for supplies can cause patient discomfort which could be prevented by ordering supplies ahead of time, when possible.

With from 15 to 20 percent of hospital annual budgets going for supplies and equipment exclusive of linen and food, economizing should be the duty of each worker on the hospital staff. After all, it is not our money but the taxpayers' and patients'; so we are under obligation to see that costs remain at a minimal level.

As student nurses we have no hand in the purchasing of supplies, but we can observe the quality of materials in relationship to their durability and cost. Thus we will have started filling in a background of knowledge for our later use.

An adequate supply of materials on the ward at all times is important. The patient can be spared discomfort if supplies are on hand when needed. Students should report all deficiencies in stock. Substitutes for the proper item are often more expensive (e.g., plain gauze sponges substituted for sponges with cotton filler).

Over-supply is not good, either — it is wasteful. Sterile supplies become outdated, and an excess of something seems to promote laxity in an economizing program. Breakage and wastefulness, of course, are detrimental to hospital economy. The student nurse can do her share to reduce them by putting syringes and glassware where they won't be knocked off, and by reporting all breakage.

If a needle is bent, it should not be straightened, but returned to central supply, where it can be properly handled. Following this rule makes it possible to keep a complete inventory of all stock.

Deterioration and softening of rubber catheters, rectal tubes, and draw sheets occur if they are not properly c l e a n e d. Lubricating substances should be rinsed off them as soon as possible. Ice bags and hot water bottles should be thoroughly dried (to prevent sticking together) and inflated before storing. Any measure which prevents breakage and wastefulness in using supplies contributes to the economy of the hospital.

Student nurses, as well as new interns and medical students, should be instructed as to the proper care and usage of equipment and supplies. If students see someone using faulty technic which would in any way be detrimental to t h e patient, they should give instruction at the time or report the matter to the head nurse, if it is a touchy situation.

Students should know the contents of various trays well enough to be able to set them up on the floor or to instruct their preparation in time of emergency. They also could make posters illustrating and emphasizing cost of supplies and the need for their careful handling. These posters could be saved and re-used when a new group of students came on the floor.

Although central supply plays an important role in the plan for total patient care, we are prone to think of it as an isolated unit. Communications between the floor and central supply could be improved if the proper requisitions were filled out correctly when breakage is reported and stock supplies are requested. Jangled nerves on both ends can be avoided if supplies are ordered before the time of treatment, when possible.

Good interdepartmental relationships can be established if each worker in the nursing team (which includes the central supply department) has a thorough knowledge of his job, understands the importance of his job to the whole, has the ability to work well, and the disposition to cooperate.

By Martha Ann Evans

● The student nurse can improve patient care in the following ways:

(1) By caring for the patient with the best possible equipment and supplies for his particular situation or condition.

(2) By treating the patient in the least traumatic way—using the correct procedure—and informing him about the coming events.

(3) By guarding against infection to the patient being treated and others in the hospital, through the use of sterile equipment and aseptic technic, and proper disposal of used articles.

(4) By using the services available to provide for the patient's peace of mind and comfort.

She can also improve hospital economy by using supplies intelligently, in these ways:

(1) By causing less waste and breakage of supplies, and using equipment to the best advantage.

(2) By cutting down on infections and trauma, shortening the time patients would spend in the hospital, and

guarding against injuries to patients, which might result in costly lawsuits against the hospital.

(3) By insuring the availability of an article which may be needed in several places at once.

(4) By better use of professional time and personnel.

These objectives can be accomplished by using proper technics, maintaining a sterile field, making proper disposal of used articles, using correct supplies, and making orderly and efficient use of time and equipment.

Preaching, practicing, picturing, and providing literature are the four P's the student can use to help teach others the correct technics and care of equipment used. Not only must she tell someone how to do something but she must also practice the correct way if she expects others to do likewise.

Illustrating what has just been said by drawings, skits, slides, or demonstrations—is also helpful in teaching. To further the learning process, literature should be provided which pertains to the subject in question.

To help improve communications and human relationships between central supply and the nursing units, the student nurse can do the following procedures (or see that they are done) which central supply asks the floors to do in order to speed up central supply service and make it more efficient.

Fill out requisitions properly and completely, using the correct one for the purpose in mind; wash out syringes with clear water immediately after use, to prevent hardening of material within them; collect articles after use in a central area, to simplify their pick-up for central supply; return supplies which can be used again to the central area as soon as possible, so that they may go into circulation without delay and waste of time, money, and effort.

By Janet Teague

● The modern hospital service for sterilizing and distributing equipment —the central supply service—makes the work of the nurse and the student nurse much simpler today than it has ever been in the past.

Only in the last 25 years has the hospital centralized in one area the burden of providing sufficient equipment, both sterile and unsterile, to care for the patient.

Besides improving hospital economy, insuring safer sterilization procedures, and providing increased hospital efficiency, this system permits better utilization of the professional nurse's time.

Since the nurse is no longer a "part-time dish-washer," she is obligated and able to give the patient more intelligent care. She has more time and is more physically fit to provide the treatment and instruction the patient needs for satisfactory recovery.

There are four areas in which the nurse can improve the hospital experience for the patient, in relation with the central supply service:

PATIENT CARE

Through the intelligent usage of supplies, the care of the patient is improved.

The nurse must understand and practice aseptic technic when handling any supplies which will come in contact with the patient. This means that she will not touch any portion of a sterile needle, a sterile dressing, a sterile instrument, or any sterile equipment to an unsterile area before using it on the patient. She also will not contaminate the sterile supply by careless technic.

Because the nurse comes into contact with many patients, she must know how to prevent contamination from one patient to another when a condition is communicable. If a piece of sterile equipment should accidentally become contaminated, the student nurse must discard the contaminated equipment and begin again with sterile equipment.

By concentrating on what she is doing, remaining calm, and remembering the principles of aseptic technic, she will reduce mistakes to a minimum.

Understanding the principles of sterilization gives the nurse an appreciation of sterile equipment and its usage. Understanding the general principles in the mechanical operation of the sterilizing unit, the autoclave, equips the student nurse to sterilize equipment which is still sterilized on some hospital wards.

A knowledge of when to use dry and when to use steam sterilization, and the special problems, such as exposure time, involved in each, will promote intelligent usage of equipment in the care of the patient.

PATIENT EXPENSE

One aim of the student nurse is to do her part in improving hospital economy. The expense of maintaining the hospital reflects directly on the patient.

Perhaps the most important thing the student can do to keep hospital expenses at a minimum is to have a proper respect for equipment and supplies and therefore handle them carefully.

When working in a calm, collected manner, the student may be more protective of equipment than when she is in a hurry. Again, concentration upon the task at hand is important in preventing breakage and destruction of equipment.

The student does her part by not disturbing others who are working with expensive equipment.

Rinsing equipment, such as syringes, immediately after use saves working time for central service employees and preserves the supplies.

Returning articles to their proper storage places and maintaining order in supply spaces help cut down breakage and damage.

Careful planning and using only enough equipment to carry out procedures satisfactorily may cut down expenses.

Intelligent observation and initiative on the part of the student nurse may reveal conditions which could be improved on the hospital wards and thus promote more efficient working conditions and handling of equipment.

PATIENT PROTECTION

The student nurse may learn about and apply aseptic technic and proper handling of equipment, but she will undoubtedly come into contact with persons who do not. Here she must play a very important role, for the patient pays for and deserves every precaution known to protect him while in the hospital.

The best way for the student nurse to teach others the correct procedures is to be a good example. Observation is a very painless and satisfactory learning mechanism and one of which the nurse must take advantage.

Often it becomes necessary to verbally correct a person who is using wrong technic. The student nurse, because of her position and her profession, is obligated to use every principle of good approach in correcting a coworker or a patient. She must respect the person who makes a mistake and let him know that she does so.

She should be able to explain as clearly and as precisely as possible the reasons for and the advantages of using the correct technic. She must

understand these herself before she can satisfactorily tell others.

The patient often needs to learn correct procedures so that he can assist himself, either in the hospital or after he returns home. The student nurse may need to have planned demonstrations for the patient and also to have the patient practice and explain the procedure back to her to make certain he understands it. Because reading material may be useful, the student should be familiar with material in the library, and any pamphlets pertaining to the subject.

The patient may ask questions about all the procedures and care a nurse goes through in preparing and using supplies. A ready answer, cheerfully given, may be a means of teaching. The student nurse must establish rapport with a patient and appear interested in him before she can expect him to "bother" her with questions.

PATIENT EXPERIENCE

The patient is indirectly affected by the human relationship and the communication between members of the hospital staff. When their relationship is good, the patient can feel this by the attitude of those attending him. Therefore, a good relationship between the nursing staff and the central service personnel is important.

To establish such a relationship, each group must recognize the role its members play in the total care of the patient, and also the role played by members of the other group.

Each group must respect the efforts of the other group and be tolerant of mistakes which are characteristic to all humans (themselves included).

Each must strive to understand and correctly follow the method of ordering used in the hospital.

The nurse must be very distinct in conveying the exact quality and quantity of supplies she needs, and should allow enough time before use to obtain supplies, when possible.

The nurse should especially observe the practice of rinsing supplies immediately after use if the material on them will dry and cling to the supplies. Failure to do this constitutes a "pet peeve" of central service personnel.

Both should remember that the patient is the one who suffers when nurses and central supply personnel do not have a good relationship and a good communication system.

Students' Study of Supplies, Cost, Beneficial to Hospital

By Betsey R. Carroll, R.N., with Helen Sims*

• Two senior nursing students at the University of Kansas Medical Center made a dramatic study of medical economics last October and shared the results of their investigation with their classmates, their instructors, and the general staff of the 600-bed hospital.

Students Judy Lippitt and Janice Steinbach chose as their senior project a four-week elective term in central supply service, because they felt they needed to learn more about professional supplies and equipment. Mrs. Steinbach's husband was a medical student at the University of Kansas, and she planned to help him establish a practice in a small town in Western Kansas. Miss Lippitt was engaged to marry an intern, and she planned to help him through his residency by working as a nurse.

The author, administrative supervisor in the central service department for some nine years, and her entire department of 35 employees, co-operated with the students in every way they could. The students kept them "jumping" with their eagerness to learn, to read, to investigate.

The first two weeks were spent in working on the basic procedures of sterilizing, dispensing, principles of preparation, and purchasing. This was not enough. The girls wanted to "dig deeper." With mounting enthusiasm, they learned the facts about initial costs, waste, utilization, and emergency measures.

"This story must be told," they declared. "It isn't enough for just us to know." So tell it they did. They "talked it up" with their classmates, their instructors, staff nurses, and medical students. Then they put it in writing, making effective posters as visual aids, and preparing cost analyses.

Formal presentation of the project was made in a ward-administration class—but it was more than a routine class. Present were students, instructors, and general staff of the hospital.

The presentation was divided between Miss Lippitt and Mrs.

*Mrs. Carroll is administrative supervisor, central service department, University of Kansas Medical Center, Kansas City, Kans., and Miss Sims is director of informational services.

Mrs. Janice Steinbach (r.) points to poster illustrating waste which results from carelessness in handling equipment. Looking on is Miss Smith, clinical instructor. Posters were presented at a class attended by students, instructors, and general staff.

Display depicting the trend toward time- and labor-saving devices, including disposable, sterile, prepackaged items, was assembled by Judy Lippitt.

Steinbach. Miss Lippitt explained the new trends, with emphasis on professional time-saving devices, increased comfort to the patient, and maintenance of hospital economics.

Mrs. Steinbach stressed waste with caustic "facts and figures" posters, compared the old with the new methods, and gave a cost analysis of a hypothetical hospital case. Case "X" revealed that the medical-surgical patient paid $702 in hospital bills for use of equipment and supplies with an initial cost of $1,615.90 to the hospital.

"We could have made the hospital expense even greater, if we had had time to dig deeper," Mrs. Steinbach said.

What has been the result of the project? Both students graduated the first of December, but the stimulus they created for awareness of central supply service is still going. Some of the new devices have been adopted and are standard. This conversion was accomplished with ready acceptance.

Furthermore, we believe that the realization of the cost of supplies and equipment has improved in the hospital. We wish we could have as enthusiastic a project every year in the department.

Conference Group Works To Solve CSR Problems

By Minnie M. Armstrong, R.N.*

• Nurses in the central service departments of Houston hospitals have had an active conference group for approximately four years. Though the active and potential membership is somewhat limited, because of the small number of nurses in central service work, a great deal has been accomplished toward promoting the group's objectives, which are:

• To promote better patient care.

• To study central service problems.

• To promote research on supplies.

• To promote efficient service.

• To promote standardization of supplies.

• To establish a means for exchanging ideas.

There are about 20 members from 10 hospitals. The meetings are held monthly (except in June, July, and August) at the various hospitals, on a week-day, from 2:30-3:30 p.m.

A real comradeship was developed among the members, which has promoted good public relations. There is no hesitancy in stating problems and expressing a desire for help in solving them. Even though a problem may not be solved immediately, discussing it helps, and many times an answer is found through such group discussion.

Some of the manufacturers, especially those who make surgical dressings, have expressed their gratification for the work done within the group toward standardization of surgical dressings. The challenge is still great in this phase of supplies. Much has been accomplished, but there is still much to be done.

Prepackaged dressings, which have come as a result of group research, are a boon to all concerned. Many more surgical dressings might be prepackaged and distributed sterile by the manufacturers,

*Supervisor, central service department, Hermann Hospital, Houston, Tex.

Nine of the members of the Houston Central Service Conference Group are shown above. They are (seated, l. to r.): Wilmae Hanson, Hermann Hospital; Hazel Kramer, central service department supervisor, Memorial Hospital; Theresa Stratman Davis, VA Hospital; (standing, l. to r.) Mary Kleinfelder, St. Joseph's Hospital; Sister Teresita, supervisor, St. Joseph's Hospital; Margaret Bourdon, supervisor, VA Hospital; Mary Smith, supervisor, St. Luke's and Texas Children's Hospitals; Minnie M. Armstrong, supervisor, Hermann Hospital; and Sister Michael Joseph, supervisor, St. Joseph's Hospital.

if hospitals would and could standardize upon dressings. Standardization would prove to be more economical and would promote better technics in handling dressings, which in turn would promote better patient care.

The prepackaged dressing is only one example of what might be done as a result of group research. Many better things for hospitals and patient welfare can and do have their beginning in a small group such as this, or in several such groups.

The program for our organization for 1957 was as follows:

January — "Safe and Efficient Usage of Oxygen" (including Linde Oxygen film).

February — Comparative study panel on "Economics and Advantages of the Disposable Enema."

March — "Increased Usage of Radioactive Minerals in Medicine: Nursing Care Precautions; Care of Equipment and Supplies and Waste."

April—Report on the Steriphane method of handling syringes and needles.

May — "New Plastics and Prepackaged Supplies."

September — "Committees and Channels of Communication As They Concern Central Service Departments."

October—Panel on intercommunications.

November — "Emergency Packs and Equipment."

December—Annual meeting and Christmas party.

Our group was set up as a conference group of District 9 of the Texas Graduate Nurses' Association. Therefore only members of that association may be voting members of the conference group. However, non-nursing personnel may be invited to attend sessions which nurse members believe will be interesting and helpful to them.

Treatment Done in Wards With 'Gyn Cart'

•A "gyn cart" has been developed by the central service supervisor at the Peninsula Hospital, Salisbury, Md., so that treatments such as cervical biopsy, sigmoidoscopy, liver biopsy, etc., can be done in the patient's room or on the ward.

The supervisor, Georgia Lee Collins, R.N., devised the cart because the hospital's physical setup does not include treatment rooms in the patient areas and the operating room schedule is filled with major surgery.

Moreover, Miss Collins points out, it seemed inadvisable, both psychologically and economically, to expose a patient to the operating room for a minor procedure, such as cervical biopsy. Hospital personnel felt that the accident room should not be responsible for these treatments on inpatients.

Included on the cart are supplies and equipment for treatment of vaginal hemorrhage.

On the three-shelf portable, stainless steel cart are:

A tray containing:
- 3 uterine tenaculum
- 1 uterine sound
- 8 Hegar dilators—graduated sizes
- 1 uterine packing forceps
- 1 cervical biopsy forceps
- 2 8" Kelly clamps
- 3 6" Kelly clamps
- 1 sponge stick
- 1 medium bivalve speculum
- 1 small bivalve speculum
- 3 wooden Pap smear sticks
- 1 emesis basin
- 2 surgical tissue specimen bottles
- 2 medicine glasses
- 2 single sheets
- 2 towels
- 6 4x4 gauze sponges
- 6 2x2 gauze sponges

Can 4x4 sponges
Jar of cotton balls
Gauze vaginal packs
Gloves—assorted sizes
Sponge stick and forceps jar
Solution for specimens
Solution for patient clean-up (pHiso-Hex and aqueous Zephiran)
Silver nitrate sticks
Emesis basin
Lubricant (K-Y jelly)
Pap smear container
Hemo-pac or Oxycel gauze

Below: Georgia Lee Collins, R.N., central service supervisor, Peninsula Hospital, Salisbury, Md., is shown with "gyn cart" she devised for treatments which can be done in patient's room or on the ward.

Training Technics Discussed At Tri-State CSR Sessions

Sessions for central supply department personnel were held at the Tri-State Hospital Assembly in Chicago. Abstracts of papers follow.

Fulfilling Basic Desires Helps in Motivation

Tell Employees Why You Want Them to Learn

Good training does not in itself make for good employees. Proper motivation is also needed. What motivates employees? There are several basic desires to be fulfilled:

(1) Desire to belong. It is hard to develop a feeling of belonging — of identification with the hospital and with a specific department—in persons who are scattered throughout the hospital (housekeeping employees, for instance). Since central service personnel tend to remain in one area, it should be much easier to fulfill the desire to belong.

(2) Desire for recognition—to be known and liked as an individual. It is difficult for central service to fulfill this need, because any feelings of prestige which nonprofessional employees may develop are often cut down unwittingly by persons with "built-in prestige" (professional persons).

(3) Desire for security. Hospitals have quite a bit of job security in comparison with industry, but even with job security there can be much insecurity — from constant changes without explanation, lack of human treatment by those in authority, or poor coordination, for example.

(4) Desire for new experience. Many hospital jobs have a great deal of variety, but because of the many repetitive jobs in the central service department, it may be difficult to fulfill this desire.

When these basic desires are not fulfilled, the results are lonelilness and neglect, insecurity and boredom.

There are basic laws of learning which must be taken into consideration, or the best training technics will be meaningless. These laws are:

(1) Learning must be motivated. People are not naturally inclined to learn. You must show them the rewards, and let them know why you want them to do what you want them to do. Then praise them for their successes.

(2) Persons undergoing a learning situation respond best to things that are meaningful to them. Go from the known to the unknown — again, tell why.

(3) A person learns best when he is ready to learn. Remember that he cannot concentrate on more than one thing at a time.

(4) Learning involves activities—physical as well as mental.

(5) Repetition is essential.—**Russell McBride**, Training Specialist, Johnson & Johnson, New Brunswick, N.J.

Speakers at one session were (l. to r.): William D. M. Snell, assistant chief engineer, Henrotin Hospital, Chicago; T. N. Silzer, personnel director, Johnson & Johnson, Chicago; and Russell McBride, training specialist, Johnson & Johnson, New Brunswick, N.J.

Administrator Tells What He Expects of CSR

Warns of Quick Changes With Little Preparation

Some desirable goals which can be achieved through a properly functioning central service department are: better standardization of materials; good maintenance and control of equipment; a smaller over-all inventory, and economy of time, energy, and motion.

To accomplish a smooth-functioning department, we need adequate space, if possible. We need constant study and use of methods improvement technics, and an awareness of the needs of the nursing units and a real appreciation of their problems.

We need a supervisor for the department who is willing to investigate and change, and is constantly evaluating the products used.

We need and expect economy — of operation and in use of supplies. We

need a standard, simple manual that will inform all those in the hospital who are concerned what this department is supposed to do.

No changes should be made in or by central service without prior consultation with everyone concerned. Any proposals for controls or changes should be well explained in advance and carefully documented.

We need the confidence of everybody in the hospital in this department. The supervisor must realize that her responsibility is to give service, and she may have to "sell" other departments on her service.

I believe in complete central service, not just controlled service. However, acceptance by other services in the hospital then presupposes adequate services.

To broaden its usefulness, the department should be responsible for all miscellaneous equipment that is stored, unless there is some specific reason for putting it in another department. There is some trend toward acceptance of this concept. Of course, adequate space is essential. I think all planning should allow for space for such storage.—**Leonard P. Goudy**, Administrator, Proctor Community Hospital, Peoria, Ill.

85% of New Items From Hospital People

Describes Steps in Evolution of Product

Eighty-five percent of all new items added to a hospital line come from persons directly connected with hospitals. Ideas for products are welcomed.

There are eight steps in the evolution of a new product:

(1) Statement of the problem—including a definition of what is wanted, a description of present methods of doing the job and of methods which have been discarded, and a list of characteristics the new system must have.

(2) Suggested means of solution. This may come from constructive new thinking on the part of one person, the inventor; from the various suggestions of a group of persons participating in a brainstorming session, or from outside experts. Or the suggested solution may be an adaptation of presently used ideas or systems from another field.

(3) Combination and modification of suggestions to arrive at a new item.

(4) Market survey — to determine the market potential and the ability of the product to do the job.

(5) Redesigning for production. This is an essential and expensive step.

(6) Manufacture.

(7) Distribution. Among factors to consider are packing, stocking, handling, and shipping. If a distributor is to take on a new item, there must be enough margin to carry this overhead expense.

(8) Promotion, including literature, bulletin advertising, advertising in periodicals, technical explanations, commissions to salesmen, and samples. —**Basil Burrell**, Research Engineer, American Hospital Supply Corp., Evanston, Ill.

CSR Bi-State Group Holds Institute in Kansas City

• A one-day educational institute for central service personnel was held in 1958 at St. Luke's Hospital Kansas City, Mo., under the sponsorship of the Central Service Nurses Association of Missouri and Kansas.

The institute, designed to stress practical knowledge and technics, is part of the educational program of the bi-state central service group which organized on a statewide basis last year.

At a business meeting preceding the institute, the group voted to affiliate with the National Association of Hospital Central Service Personnel. This group thus becomes the first local organization to join the national association since incorporation of the national group in 1958 at the Tri-State Hospital Assembly in Chicago. Membership in the national group is open to all central service staff members.

The Kansas and Missouri group began meeting monthly in the Kansas City area five years ago. Heading the group during its organizational period was Mrs. Betsey Carroll, central service supervisor, University of Kansas Medical Center, Kansas City, Kans., who served as president until last month.

New officers of the group are Harriet Melland, central service supervisor, Grace Hospital, Hutchinson, Kans., president; Gertrude Stumpf, central service supervisor, Kansas City (Mo.) General Hospital No. 1, re-elected vice-president; Mrs. Janet Randell, central service supervisor, University of Missouri, Columbia, secretary; and Marjorie Feleay, central service supervisor, Providence Hospital, Kansas City, Kans., treasurer.

Following are excerpts from some of the talks given at the Kansas City institute.

Prepackaged Dressings Called Time, Labor Savers

Clinical Studies Standardize, Simplify Surgical Dressings

A great contribution has been made to the standardization and simplification of surgical dressings by clinical studies on postoperative wound care. These have resulted in a classification of postoperative wounds from the standpoint of treatment, particularly relating to drainage.

Manufacturers have designed dressings to fit these classifications, thus enabling simplification of dressings.

Following the development of items specifically designed for the various classifications of postoperative wounds, an evaluation was made of the advantages of prepackaged dressings.

It was found, by keeping time and motion study flow process

New and outgoing officers of the Central Service Nurses Association of Missouri and Kansas are: (seated, left to right) Gertrude Stumpf, central service supervisor, Kansas City (Mo.) General Hospital No. 1, re-elected vice-president; Mrs. Betsey Carroll, central service supervisor, University of Kansas Medical Center, Kansas City, Kans., past president; Patricia Tolle, central service supervisor, Research Hospital, Kansas City, Mo., past secretary; (standing, left to right) Harriet Melland, central service supervisor, Grace Hospital, Hutchinson, Kans., president; Marjorie Feleay, central service supervisor, Providence Hospital, Kansas City, Kans., treasurer; Lois Collins, central service supervisor, Menorah Medical Center, Kansas City, Mo.; and Mrs. Janet Randell, central service supervisor, University of Missouri, Columbia, secretary.

Below, left: Helen Reynolds, director of in-service program, Research Hospital, Kansas City, Mo., spoke on "Educational Programing for Nurses and Auxiliary in Central Service."

Below, right: Don Meyer (l.), Kansas City representative of Johnson & Johnson, assisted H. C. McNamer, Jr., manager, midwestern hospital division, in presenting his talk on "Pre-Packaging —the New Trend." Mrs. Erma Thomason, central service supervisor, VA Hospital, Excelsior Springs, Mo., and Mrs. Mary Olive Hageman, central service supervisor, VA Center Hospital, Wadsworth, Kans., discuss a problem with Mr. McNamer following his talk.

charts in the hospitals, that for most surgical dressings, the small additional cost of prepackaged items was offset by the saving in labor.

In a 350-bed hospital, when 4"x4" prepackaged dressings were substituted for 8"x4" bulk dressings, 96,000 fewer units were used in a year's time, resulting in a saving of $1,587. Large savings in money were recorded in other hospitals, indicating greater control of use of products and less waste with use of prepackaged items.

In addition to a saving in labor and money, another advantage of prepackaged dressings is improved aseptic technic. In a study made in a West Coast hospital, reduction of postoperative wound infection when prepackaged dressings were introduced was found to be more than 80 percent. —*H. C. McNamer, Jr.*, manager, midwest hospital division, Johnson and Johnson.

CSR Supervisor Often Acts As Purchasing Agent

Dual Role Enables Her to Control Inventory, Use, Care of Supplies

Just as rapid changes are taking place in the entire field of medicine, changes are taking place in the role of the central supply supervisor regarding purchasing.

In the not too distant future, these supervisors will be buying bones, veins, arteries, and kidneys. They will carry out a dual job, however, and also dispense these items.

An advantage of this situation is that the supervisor may solve storage problems in the hospital by keeping the inventory small. She is able to keep equipment in good working order and knows when replacement and repairs are necessary. She controls usage and keeps equipment available.

Intelligent purchasing means knowing when to buy at the best price and buying only supplies that are needed. Constant comparing of prices, and standardizing of supplies and equipment help keep costs down. — *Mrs. Harriett Melland, R.N.*, central supply supervisor, Grace Hospital, Hutchinson, Kans.

Proper Equipment Is Vital For Effective O_2 Therapy

Complete Records of Use Must Be Kept for Realistic Budgeting

Oxygen, important in patient care in many situations, has often been used haphazardly. For proper oxygen therapy, equipment must be in good working order. The care of oxygen equipment requires constant attention.

The storage of oxygen equipment is a problem which can be solved by setting up a systematic procedure.

Functioning equipment should be stored in one place; equipment needing repairs in another.

Hospital engineers may make racks and trays for the storage of equipment, thus providing the proper receptacles for storing each individual piece.

Valves may be mounted on a board. Rubber masks, which deteriorate easily, may be hung on straps.

Oxygen tents must be washed and sterilized before being stored. A rubber garden hose or a dishwashing brush which holds a detergent in the handle may be used for washing. Vinegar in the rinse water maintains the clarity of the plastic. After washing, the tents should be sterilized by means of cold sterilization.

The mechanical chamber and coils of oxygen tents should be checked monthly to see that they are in operable condition and ready for immediate use.

Old equipment should be replaced when necessary; this practice results in greater economy, as records have shown.

Oxygen therapy may contribute to a hospital's deficit if accurate records are not kept and each patient is not charged for the material and service he has received. —*Gareth Gish*, technical sales department, Puritan Gas company, Kansas City, Mo., and instructor in department of surgery, University of Kansas Medical Center.

Above left: Patricia Tolle (right) assists Betsey Carroll in adjusting the orchid corsage Mrs. Carroll was given by the central service nurses in recognition of her work as chairman of the group for four years.

Below, left: Among the members who attended the institute luncheon were (l.) Evans Webster, central service supervisor, and Mildred Durr, director of nurses, both of Coffeyville (Kans.) Memorial Hospital.

Above, right: Participants in the institute program included Richard E. Burgess (l.), director of technical services, and Carroll Devine, assistant to sales manager, both of Pharmaseal Laboratories, who gave talks on "Better Patient Care with Plastics;" and Mary Helen Anderson, who spoke on "Developing Standardization Within Central Service." Miss Anderson is chairman of the National Association of Hospital Central Service Personnel.

Below, right: Oxygen therapy service and equipment was discussed by Gareth Gish, member of the technical sales department of the Puritan Gas Company, Kansas City, Mo., and an instructor in the department of surgery at the University of Kansas Medical Center. He is shown here with Mrs. Bernice O'Reilly, head nurse in central service at St. Luke's Hospital, Kansas City, Mo., and program chairman for the institute.

Good Training Program Is Planned in Advance

Non-Professional Workers Should Know Their Function on Team

A training program in the central service department begins with a job roster—a card or a chart—on which are shown the department, station, job title, date, name of employee, date assigned, and age.

Job specifications list every duty the employee on that job will be expected to perform.

A job rating form provides a means of evaluating the employee's training needs. On the basis of this, the extent of the training program is determined and plans are made.

A job breakdown is then made, consisting of descriptions of procedures for the tasks to be performed.

These procedures must then be taught by someone clearly designated to carry out the training program—one who is free to do so without the interruption of administrative duties.

The non-professional worker is a particular responsibility of the person in charge of training. This worker needs to be taught hospital ethics and behavior, and must be taught how hospitals differ from other businesses.

She needs to know the importance of her job, and to understand the vital role that cleaning, packaging, and sterilization of hospital supplies plays. She should be made to realize that carelessness in the timing of an autoclave can mean a serious and possibly even fatal infection for one or several patients. —*Helen Reynolds, R.N.*, director of in-service program, Research Hospital, Kansas City, Mo.

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